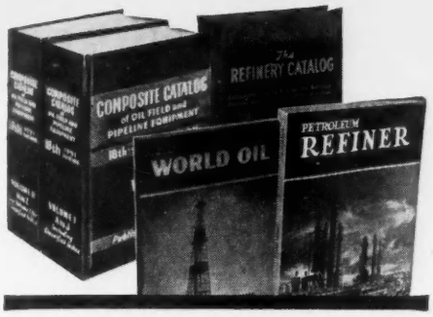

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for the refining-natural gasoline industry

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The Permian Basin

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WORLD OIL

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Current Outlook Section

L. J. LOGAN, SECTION EDITOR

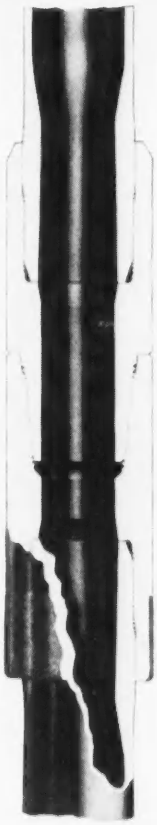
WORLD OIL

W. F. "Fat" Jordan, owner of Hartman & Jordan Drilling Company, Mount Vernon, Illinois, says:

These REED products help me keep down drilling costs

"REED Rock Bits give good, long runs"

"My drillers make hole fast with **REED** Rock Bits. Regardless of the formation, regardless of drilling conditions, I can depend on getting good, long runs with **REED** Rock Bits."



"My records show REED Tool Joints last longer"

"Tool joints can be a very expensive item, but I keep costs down by using **REED** Tool Joints and insisting that my men follow approved handling practices. In that way I keep tool joint costs down."

"I get good, clean cores with REED Core Drills"

"I am convinced that you can't beat **REED** Core Drills for long, clean cores. I use them regularly in my coring operations."

REED ROLLER BIT COMPANY

HOUSTON 1, TEXAS

THE MARK OF QUALITY

Gulf Coast, Mid-Continent, Rocky Mountain and Canadian Distributor for Martin-Decker Products

2978

Oil Must be Discovered!

and Subsidiary Companies
are operating in . . . . .

UNITED STATES
CANADA
MEXICO
VENEZUELA
ITALY
KUWAIT (Neutral Zone)
TRUCIAL COAST
NIGERIA
TRINIDAD
PAPUA

To provide a sufficient supply of oil for the increasing world demand, it is imperative that more oil must be found daily than is being produced. To find this additional oil the exploration effort must be constantly accelerated. As the search continues the new areas of potential oil production become more difficult of access and the old ones require more detailed exploration to solve the geological problem. This is true not only of domestic exploration, but also of all other areas of the world.

In its continuing endeavor to render an unexcelled service to the oil industry SSC will provide adequate and proper facilities to meet the growing needs of oil exploration throughout the world.

Seismograph Service Corporation

Seismic Surveys — Gravity Surveys — Pilot Surveys — Lorac

TULSA, OKLAHOMA, U.S.A.

Looking Ahead

PETROLEUM DEMAND AND PRICES may be softened by end of Korean War. Oil markets are affected directly by general business activity, which may show letdown if and when shooting stops. Some retailers forecast decline of 6 percent or more in sales within month after cease-fire orders and drop of 8 to 10 percent or more in retail prices three to six months after end of shooting.

THROUGH PAD, oil companies have made preliminary plans to alleviate shortages that would be caused by shutting off flow from Iran. Increase in U. S. and Caribbean crude production capacity would be required, but existing refining capacity in "free world" could largely replace runs of 485,000 barrels daily at Abadan refinery.

VENEZUELA DOES NOT HAVE reserve-producing ability to supply much of the oil that would be needed to replace oil from Iran if Iranian output is interrupted. Venezuela's present record production of about 1,700,000 barrels daily is close to maximum efficient rate, although operators hope to raise capacity to 2 million daily by early 1952. About 610,000 barrels per day of Venezuelan crude and products now go to U. S.

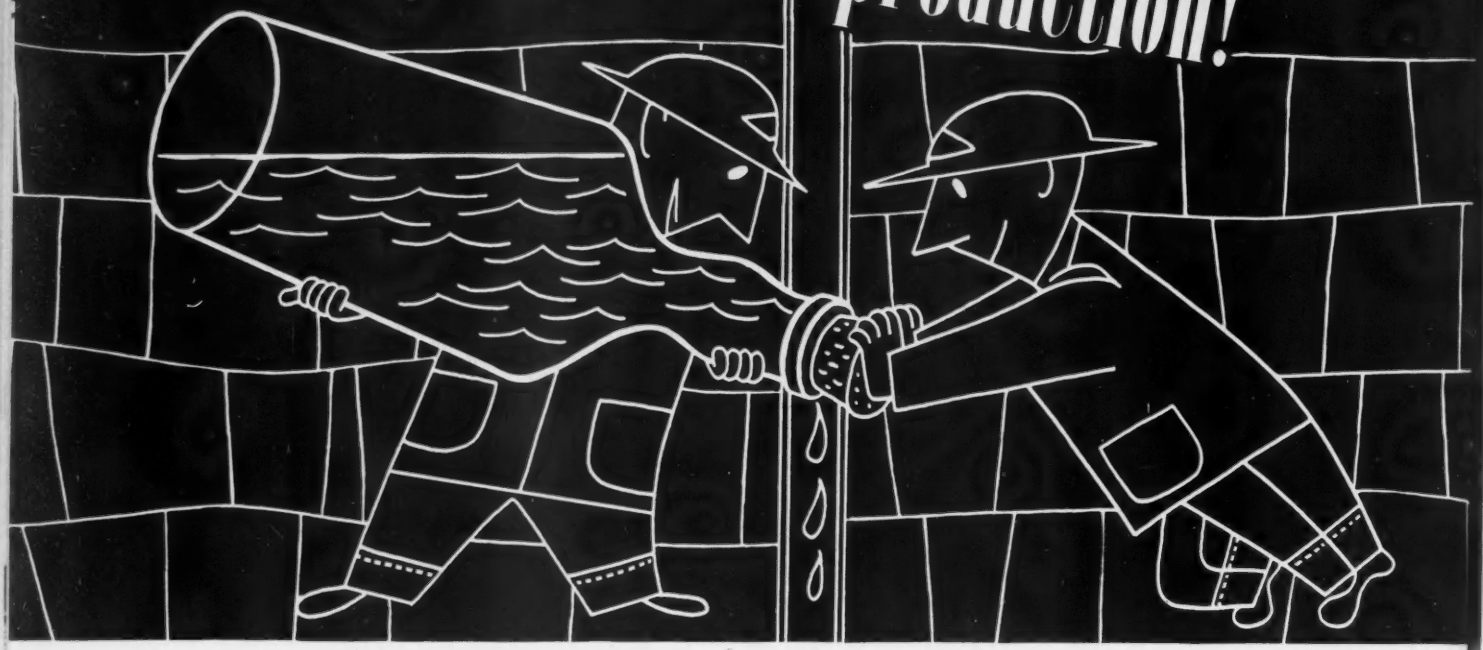
OIL AND GAS PRODUCERS will not rush into long-range plans for selling gas, despite FPC's 4 to 1 decision in Phillips case, declining to assert controls over producers. Operators know FPC has reversed itself in past and may do so again. They want Congress to enact legislation specifically declaring producer exempt from utility regulation by FPC.

TO MEET INCREASE of 8 to 10 percent in demand for its products, U. S. oil industry this year will spend $4 billion, including $3 billion for new capacity and $1 billion for replacing old facilities, reports API, raising early-1950 estimate 25 percent.

ROBOT-TYPE RIGS which will do everything for driller except think are predicted for early future. Automatic controls are being developed to permit devices on drilling rigs to operate by themselves after proper adjustment by driller and to take care of variances in operation without further correction. Similar automatic devices are also on engineering boards designed to permit remote control operation of producing properties.

COAL INDUSTRY henceforth may offer oil and gas more competition, predicts U. S. Chamber of Commerce. Aiding sales of coal will be: (1) competition of coal gas-turbine locomotives with diesel-electrics; (2) possible production of synthetic fuels from coal; (3) possible use of coal in replacement of Iranian oil; (4) existence of hundreds of years' supply of coal reserves, against possible continued maintenance of oil and natural gas reserves equal to 15 to 20 years' supply.

PLUGGING for more production!



WATER SHUT OFF to Increase Oil Production by Dowell Plastic Service

Water entry into an oil well can reduce production, increase lifting costs and waste reservoir energy.

A new well made considerable water on completion. Water Location Surveys made with the Dowell Electric Pilot revealed the point of water entry to be a top section close to the casing seat. Dowell engineers used plastic to shut-off this water. First, gravel was dumped on bottom and capped with plastic to protect the lower producing section. After the cap had set, additional plastic was squeezed in the section between the cap and the casing seat. Following this, the plug was drilled through and the bottom section of the well was shot. Results were excellent . . . production was 240 BOPD *with no water.*

Many workover and recompletion jobs have been successful as a result of Dowell Plastic Service. Experienced Dowell engineers spot the plastic in the right place using specially designed bailers or tubing squeeze techniques. The plastic enters the well as a fluid . . . hardening to an impervious solid after a predetermined time. Dowell Plastics penetrate the formation producing a positive bond and providing a permanent plug against encroaching fluids. Dowell Plastic Service has also been used to good effect in correcting high gas-oil ratios, in setting liners and in consolidating loose sands.

Ask your local Dowell station or office for complete information on the many uses of Dowell Plastic Service in your well workover and completion programs.

DOWELL INCORPORATED
TULSA 3, OKLAHOMA
Subsidiary of The Dow Chemical Company

DOWELL

PLASTIC SERVICE

Ask your nearest Dowell Station for complete information on these Dowell services and products: Acidizing Service, Electric Pilot Services, Plastic Service, Chemical Scale Removal Service for heat exchange equipment, Jelflake, Paraffin Solvents, Magnesium Anodes for Corrosion Control, and Bulk Inhibited Hydrochloric Acid.

"First in Acidizing . . . since 1932"

Look to **DOWELL**

FOR OIL INDUSTRY CHEMICAL SERVICE

Editor's Page

A NEW PRODUCING FRONTIER

IT IS HIGHLY ENCOURAGING to note the great progress made in petroleum production engineering during recent years. With oil becoming more difficult to discover in the U. S. as evidenced by the increase in wildcat drilling without a corresponding gain in volume of oil found, this country may be dependent to a large extent upon the development of better producing methods to provide an adequate supply that can satisfy unprecedented future demand for petroleum.

Until a comparative few years ago petroleum industry research was confined mostly to refinishing operations and the search for new and improved consumer products. Production research developed slowly because oil was plentiful. Steady progress was made in recovering more of the oil contained in reservoirs. The benefits of proper flow control, water flooding, and a great many other techniques became known during the past 25 or 30 years. However, only in recent years has the industry engaged in extensive production research activities in this all-important phase. Of the approximately $75 million spent on oil research as recently as 1947, only 15 percent was on production work. This represented a great expansion over preceding years. Last year the industry is estimated to have spent in excess of $100 million on its research efforts, and probably one-fourth of the amount went into production operations.

• • •

ALREADY THE RESULTS have been highly gratifying. Several promising developments have been announced during the past two months. Encouraging results are being obtained through heating of water injected into producing formations in Pennsylvania. Still another project indicates the recovery of water-flood operations may be increased by the introduction of surface-active chemicals made from beef tallow. It has been discovered that carbon dioxide may make possible the recovery of oil that otherwise would not be producible, and that the use of detergents in producing operations may be attractive. These are but a few of the more recent experiments that promise to enlarge the recovery of oil.

The encouraging results to date indicate that vigorous research can lead to the development of techniques which will make it possible to produce more oil from known fields. Recoverable reserves will be increased appreciably by each step in this direction, extending operations further and further into marginal fields.

Along with any progress in improving the recovery of oil, the industry should investigate thoroughly the possibilities of applying secondary recovery methods to all properties. If this is done systematically, the industry would find many places where such operations could be employed satisfactorily and profitably.

• • •

GREATER ACHIEVEMENTS in this direction are likely in the future, for production research remains a largely virgin field. Progress in recovering more of the oil contained in discovered fields may be the new frontier which can keep the U. S. adequately supplied with oil in the future.

It has been estimated that at least 100 billion barrels of oil located in already discovered U. S. fields are not recoverable by presently employed methods. If during the next 50 years research should make one-half—50 billion barrels—of this quantity producible, it would represent an amount exceeding the 41 billion barrels produced in the U. S. during the past 90 years.

Warren L. Baker

here's the plug

proved best by thousands of runs

Truth of the saying "Nothing succeeds like success" is outstandingly proved by the BAKER RETAINER BRIDGE PLUG! The "well proved" design—based upon the long famous Baker Cement Retainer—has performed successfully in countless thousands of wells—for every purpose—at all temperatures—and at all depths.

IDEAL FOR EVERY PURPOSE

For new well completions, work-overs, testing, squeeze jobs, well abandonments, and many other installations, you can be sure of fast, efficient, economical results with the Baker Model "K" Retainer Bridge Plug—Product No. 400.

The design of the plug affords ample clearance for fast, safe running-in, and the slips set quickly and positively. The packing element is held in sealing position by lead seals; packs off against all differential pressures; and prevents movement of fluid or gas either up or down the well. There is no need to place cement above the Baker Retainer Bridge Plug to effect a perfect seal, but, if desired, you can dump cement *on the same run* by using a Baker Model "B" Dump Bailer.

YOUR CHOICE OF TWO EASILY DRILLABLE TYPES

For temporary service, choose the Baker MAGNESIUM ALLOY Type Bridge Plug; for permanent installations, specify the CAST IRON Type which is stronger than the casing, and will outlast the casing if harmful well fluids are a problem. Either type drills up in record time because the drilling bit contacts the *very minimum* cross-sectional area; the *short over-all length* reduces drilling time; and the *segmented cast iron slips* are quickly broken up with cable tools, or a rotary bit.

CHOOSE YOUR SETTING METHOD

A BAKER BRIDGE PLUG (Product No. 400) can be set on tubing or drill pipe (in the same manner as the well known Baker Cement Retainer) but in these days of pipe shortages we suggest that you contact your choice of the leading wire line service organizations for setting a Baker Bridge Plug (Product No. 400-D) on an electrical conductor cable. You can thus avoid wear and tear on your tubing, and worthwhile savings of time result from wire line setting, particularly in deeper wells.

ARE YOU USING THE BAKER ADVISORY SERVICE?

Why not call the Baker representative in your area and discuss with him installation of a Baker Bridge Plug? You will find that he has valuable knowledge and helpful suggestions to solve your problems.

BAKER OIL TOOLS, INC.

HOUSTON • LOS ANGELES • NEW YORK

BAKER Model "K" PRODUCT NO. 400 RETAINER BRIDGE PLUG

The Changing Panorama

Industry Workers Can Cite Multiple Benefits

THE AVERAGE oil industry worker is beneficiary of a "hidden pay check" equivalent to about $50 per month, representing payments, credits, and benefits paid for by employers over and above compensation for services actually rendered.

The oil company pays the full cost of vacations, holidays, pay during periods of illness or injury, state unemployment insurance, industrial compensation, and many other items. The company also participates with the employe in jointly paying for such things as pensions, group life insurance, group hospital insurance, and Social Security.

The June issue of *The Sohioan*, Standard Oil Company of Ohio magazine, stated that in 1950 all these benefits cost the company more than $6.6 million, an average of $616 per employe. This was more than 15 percent of the payroll. And in 1951 the cost will be higher.

"This hidden pay check is the money Sohio pays out for the security and well-being of its employes," said the article.

"The greatest benefit we enjoy from all these extras is the feeling of security they provide. Knowing that most of life's hazards have been anticipated and provided for, Sohioans have fewer worries and lead happier lives. That's something that can't be measured in dollars and cents."

Along with the article was a table itemizing the costs of 22 different benefits for employes and showing what percent of the payroll each item was equivalent to. In the form of vacation pay, holiday pay, and non-occupational illness and injury the company's cost was almost $3.3 million, equivalent to 7½ percent of payroll. These items represented nearly one-half of the total benefits. Other benefits listed included: military training pay, military bonus, group life insurance, retirement plans, hospital plan, adjusted group life insurance payments, jury duty, death in family, occupational illness and injury, personal absence, benefit plan administration, discounts by credit card, education plan, recreation clubs, cafeterias and lunch rooms, medical services, unemployment insurance, federal old age benefits, and industrial compensation.

Microwave Spreading In Pipe Line Industry

OIL AND GAS PIPE LINE systems are expected to employ increasingly the microwave communications system, sending phone calls by wireless relay towers instead of wires. The message is converted into electrical signals, sent by wire to a nearby transmitting antenna, and then changed into microwaves, similar to conventional radio waves but far smaller. The antenna sends microwave signals in a line of sight beam to a relay station 25 to 40 miles away. The relay station similarly picks up, amplifies, and boosts the signals on to the next relay station. The stations are located on highest ground available and on towers. On reaching their destination the signals are converted back into words. The system is being used for long distance telephone messages and also for transmitting both the sound and pictures of television. It offers an important advantage of small use of copper, lead, and other materials required for wire and cable systems.

About a dozen oil and gas pipe line companies have installed or ordered microwave systems, including Transcontinental Gas Pipe Line Corporation, which operates an 1850-mile line from Texas to New York. Keystone Pipe Line Company, subsidiary of the Atlantic Refining Company, operating a products line between Philadelphia and Pittsburgh, communicates by microwave beams from the home office in Philadelphia to pumping stations more than 60 miles away, and contemplates extending the system to Pittsburgh. Mid-Valley Pipe Line Company has in service 1000 miles of microwave beams between Longview, Texas, and Lima, Ohio. El Paso Natural Gas Company has been installing a 500-mile microwave system between El Paso headquarters and compressor and delivery stations on its line between Fruitland, N. M., and Topock, Ariz.

Some pipe line executives foresee the possibility that microwave facilities will fulfill the dream of push button operation for pipe lines, permitting an operator from a central control point to start and stop engines, open and close valves, read meters, control pressures, and do almost all other things now done manually.

One company already is operating three booster stations by microwave signals sent from a central point. They are entirely unattended by operating personnel. Another booster station due to be completed in September will also be microwave monitored and operated. It will be located at Sterling City, Texas, and will be operated from Colorado City, 40 miles away.

AAPG Head Calls for Aggressive Oil Quest

THE RECENT DISCOVERY of commercial oil in North Dakota is proof of the success that an aggressive exploration campaign in many other sections of the country can hope to achieve, according to Frank A. Morgan, president of the American Association of Petroleum Geologists.

Speaking informally to a group of oil editors in Tulsa, Morgan declared that "an airplane flight of 1000 miles in any direction from Tulsa" will cross virgin basins, not thought of as yet, which will produce oil.

"But we must drill more wells than we drilled last year if we are to maintain an adequate discovery rate," declared Morgan, who is manager of exploration for Richfield Oil Corporation.

"Exploration work must be kept at a high level of activity. It takes the drill to find oil. Geologists must have authority to drill core holes deeper."

Morgan also emphasized the need of keeping key men on the job. This point was brought out because many oil companies are reporting losses of key men to government and military service.

"It is most important that we keep our key men in exploration jobs. The extent of discoveries of oil is closely related to the magnitude of effort in exploration, and this effort cannot succeed unless we have the services of experienced geologists and geophysicists to direct intelligent exploration programs. It always has been that way and there is nothing to indicate that it will ever be otherwise."

Report from the Observatory

INDUSTRY FLIRTS WITH DANGER

By RAY L. DUDLEY, Publisher, and WARREN L. BAKER, Editor

CHANCES OF AN OVERSUPPLY of petroleum in the months ahead are increasing. Despite record consumption, U. S. supply has been exceeding demand since March, and in recent months by an ever-widening gap. Sizable additions have boosted inventories to a point where the industry is flirting with danger by continuing to operate at high levels. The situation is such that oversupply conditions can develop rapidly, particularly in the gasoline market.

The petroleum supply-demand outlook for the remainder of the year depends to a large degree on what happens in Korea and Iran. Cessation of shooting in Korea and settlement of the dispute in Iran would bring an immediate and appreciable oversupply problem. An excessive supply would still exist if Korean military operations continue but Iranian troubles are ironed out. Only a continuation of fighting in Korea plus a long shutdown of operations in Iran would bring U. S. supply almost into balance with demand as long as present record operating levels are maintained. The best guess is that an oversupply is most likely.

How much influence the loss of Iranian oil from international markets will have on the U. S. situation will be learned in coming weeks, shipments from that country having ceased the beginning of July and the big refinery at Abadan shutting down in late July because all tankage had been filled.

• • •

RECORD RUNS TO U. S. refinery stills in recent months, while responsible for holding crude inventories fairly stable, have resulted in refined product stock accumulations at the rate of approximately 500,000 barrels per day. Much of the increase has been due to withdrawal of gasoline from storage being held below normal for this time of year because of peak refinery output. Sharp increases also have occurred in distillate fuel oil stocks.

Unless the loss of Iranian oil substantially changes the U. S. picture, indicated supply presages additional gains in inventories during August. Should stocks continue gaining at approximately the same rate as in recent weeks, total inventories of all oils (crude and refined products) could exceed 620 million barrels by the end of August. This would be 51 million barrels, or 11 percent, greater than on August 31, 1950.

MOST DISTURBING ELEMENT is the gasoline situation. Excessive stocks are likely to be troublesome this winter, as high refinery output holds storage reduction rates below normal seasonal volumes although consumption has been at an all-time peak.

Since April 1, U. S. gasoline stocks have dropped only 17 million barrels compared with a decline of 22 million barrels in the corresponding period of 1950. In June, gasoline inventories decreased an average of only 113,500 barrels daily compared with a reduction of 232,000 barrels per day in the same month of the preceding year. Consequently, inventories of gasoline in mid-July totaled 124 million barrels, 12½ million barrels above a year ago although they had been only 8 million barrels greater than 1950 volumes at the end of March this year.

The lessened rate of withdrawal for this season of the year, and prospects that this situation will continue, is what gives gasoline such a serious aspect. Continued record refinery production of motor fuel may result in gasoline inventories totaling approximately 120 million barrels at the end of the heavy consuming season in October, or 15 million barrels more than the low point reached last year; and a weakened gasoline market would plague the industry all winter. Should 35 million barrels be added to gasoline stocks during the coming winter, a not unreasonable increase, inventories may reach 155 million barrels by next March compared with the 141-million barrel peak this year.

Meanwhile, stocks of distillate fuel oil have been rising more rapidly than usual, climbing an average of 420,000 barrels daily during the six weeks ended July 14 compared with 385,500 barrels per day in 1950. These inventories in mid-July were 13½ million barrels above year ago volumes, but were not considered excessive in view of anticipated greater demand this winter. Continuation of recent trends, however, would push distillate stocks to a record of more than 100 million barrels by the end of November, a quantity which could be excessive unless a cold winter is experienced.

All in all, the current situation dictates that the industry should be watching the new supply rate more carefully.

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easier operation
longer service life

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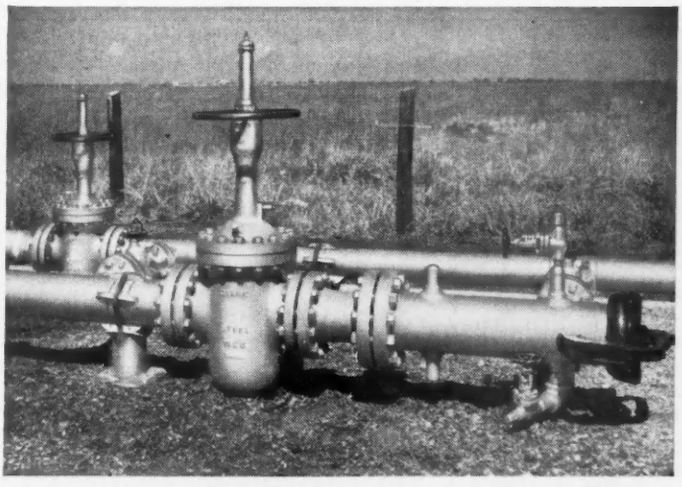
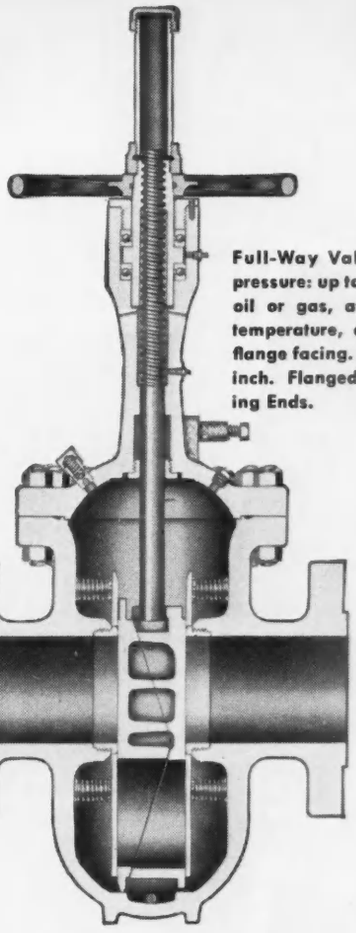
For further information, see your Crane Representative or write for Circular AD-1864. No obligation.



Crane cast steel pipe-line gate valves on scraper trap in crude oil lines.



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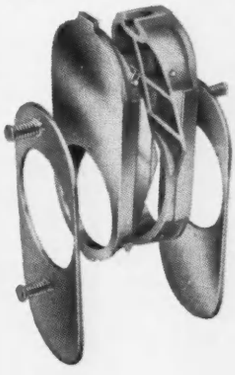

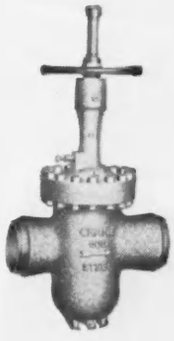

Venturi Type, available with flanged or butt-welding ends.

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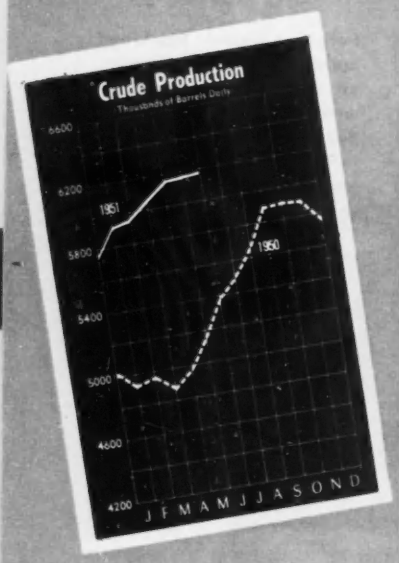
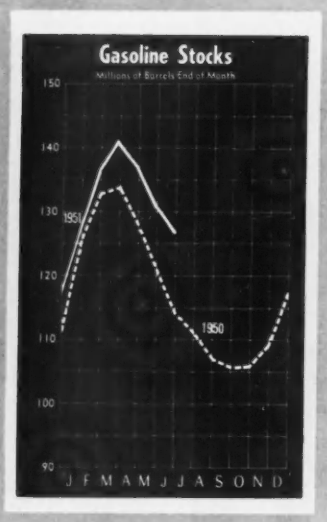
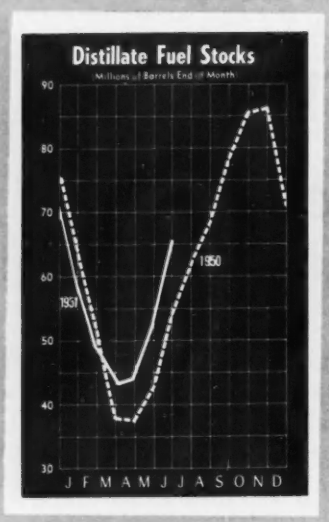
VALVES • FITTINGS • PIPE • PLUMBING • HEATING

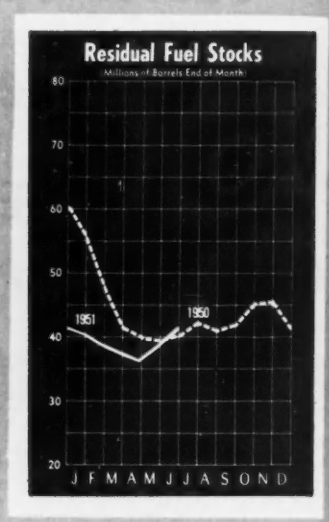
Petroleum

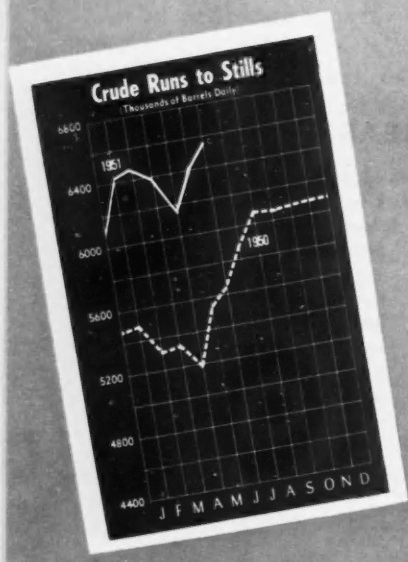
By CECIL W. SMITH

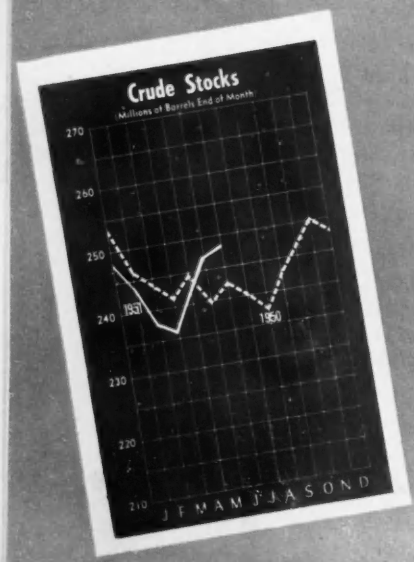












U. S. Crude Production by States

(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL PRODUCTION First Six Months		
	June, 1951	May, 1951	June, 1950	% Diff. June '51-'50	1951	1950	% Diff. '51-'50
Alabama	3.0	2.9	1.9	+ 57.9	508	298	+ 70.5
Arkansas	82.2	82.3	86.0	— 4.4	14,789	15,530	— 4.8
California	969.3	965.1	881.3	+ 10.0	174,346	156,859	+ 11.1
Colorado	73.2	73.9	59.4	+ 23.2	13,527	10,922	+ 23.9
Florida	1.7	1.6	1.6	+ 6.3	291	198	+ 47.0
Illinois	170.1	168.8	170.5	— 0.2	29,655	30,853	— 3.9
Indiana	30.1	28.8	27.7	+ 8.7	4,877	4,828	+ 1.0
Kansas	311.7	312.7	301.7	+ 3.3	56,319	51,780	+ 8.8
Kentucky	28.0	27.1	28.6	— 2.1	5,068	4,750	+ 6.7
Louisiana	646.2	645.0	568.0	+ 13.8	115,209	99,112	+ 16.2
North Louisiana	129.7	130.5	118.3	+ 9.6	22,388	22,193	+ 0.9
South Louisiana	516.5	514.5	449.7	+ 14.9	92,821	76,919	+ 20.7
Michigan	38.1	40.5	44.4	— 14.2	7,130	8,086	— 11.8
Mississippi	103.7	102.5	110.2	— 5.9	18,616	18,337	+ 1.5
Missouri	0.1	0.1	0.1	.....	13	14	— 7.2
Montana	25.0	23.9	22.8	+ 9.6	4,344	3,946	+ 10.1
Nebraska	7.2	7.7	3.2	+125.0	1,425	426	+234.5
New Mexico	142.2	141.4	130.1	+ 9.3	25,453	23,280	+ 9.3
New York	14.2	14.1	11.7	+ 21.4	2,239	2,075	+ 7.9
North Dakota	.....	.....	.....	.....	9	.....	.....
Ohio	8.6	9.4	10.1	— 14.9	1,569	1,683	— 6.8
Oklahoma	505.6	504.8	454.0	+ 11.4	91,258	75,608	+ 20.7
Pennsylvania	29.1	29.7	34.1	— 14.7	5,620	5,742	— 2.1
Tennessee	0.1	0.1	.....	.....	7	11	— 36.4
Texas	2,792.5	2,789.8	2,257.3	+ 23.7	488,870	367,920	+ 32.9
Dist. 1—South Central	33.0	33.9	28.5	+ 15.8	5,976	4,841	+ 23.4
Dist. 2—Middle Gulf	163.3	168.1	135.5	+ 20.5	29,204	21,856	+ 33.6
Dist. 3—Upper Gulf	501.2	504.2	420.3	+ 19.2	88,776	68,530	+ 29.5
Dist. 4—Lower Gulf-S.W.	261.4	260.8	213.4	+ 22.5	45,574	34,645	+ 31.5
Dist. 5—East Central	53.6	52.7	34.4	+ 55.8	9,056	5,582	+ 62.2
Dist. 6—Northeast	398.7	390.8	373.5	+ 6.7	70,057	60,560	+ 15.7
Dist 7-B—North Central	87.1	86.0	69.8	+ 24.8	14,822	11,677	+ 26.9
Dist. 7-C—West Central	105.3	103.3	62.6	+ 68.2	17,270	9,678	+ 78.4
Dist. 8—West	941.9	947.9	716.1	+ 31.5	163,864	110,089	+ 48.8
Dist. 9—North	158.3	153.5	143.7	+ 10.2	27,598	24,636	+ 12.0
Dist. 10—Panhandle	88.6	88.6	92.2	— 3.9	16,164	16,411	— 1.5
Utah	3.5	3.4	3.3	+ 6.1	630	571	+ 10.3
Virginia	0.1	0.1	.....	.....	10	11	— 9.1
West Virginia	7.6	7.5	7.9	— 3.8	1,359	1,423	— 4.5
Wyoming	188.8	185.9	161.8	+ 16.7	34,132	28,438	+ 20.0
Total United States	6,181.9	6,169.1	5,377.7	+ 15.0	1,097,273	912,701	+ 20.2

Monthly News Analysis

Industry Not Blinded by FPC Peace Pipe Smoke

Oil and gas producers have not been fully reassured that they will remain independent of utility-type regulation by the Federal Power Commission. This despite announcement by FPC July 18 of its decision that it does not have jurisdiction over Phillips Petroleum Company as a natural gas company and therefore lacks authority to regulate natural gas sales in the field by that firm. The best assurance they could have of freedom from government regulation would be specific legislation by Congress, guaranteeing such freedom, spokesmen for producers declare.

Although Commissioner Tom Buchanan dissented from the FPC decision in the Phillips case, the vote in favor of the opinion apparently was 4 to 1. The Phillips case was regarded as one through which FPC might move to assume control over production and gathering of natural gas and ultimately over production of oil, which commonly has gas associated with it.

In view of previous switches in FPC policy on the question of regulating production and "arm's length" sales of natural gas, independent oil and gas producers were advised by leading independents in the industry to examine carefully the formal order of FPC in the Phillips case and to await a crystallization of policy before making long-range plans as to their gas sales.

R. B. Anderson, of Vernon, Texas, president of the Texas Mid-Continent Oil & Gas Association, publicly stated: "This ruling is the latest in a historical series of contradictory administrative policies by the commission and by court interpretation of the Natural Gas Act. It points clearly to the need for Congressional action that will specifically guarantee the independent producer exemption from utility regulation in arm's length sales of natural gas or sales for resale. Otherwise, the independent producer will remain confused."

Oil and gas producers have emphatically contended that men who take the risk of discovery and development of gas resources should not be subjected to the utility-type regulation of FPC. They were generally gratified and encouraged, therefore, by FPC's firm opinion July 18 that it does not have jurisdiction over the production and gathering of natural gas by independent producers.

Producers were perturbed, on the other hand, by subsequent reports that FPC expected an appeal to be taken to the U. S. Supreme Court from its decision in the Phillips case. The Wisconsin state government and Detroit city officials, interveners in the case, were expected to ask the court to overturn the commission's ruling.

K. S. Adams, chairman of Phillips, declared the decision was a signal victory not only for producers but also for the consuming public. "It is hoped that this will be the end of agitation with each change in membership of the commission to reverse previous decisions and subject independent producers and gatherers to regulation.

"An unregulated industry can and will develop far greater supplies of this premium fuel than could ever be expected through regulation. Greater supplies and free competition between gas producers and with other fuels will hold prices at reasonable levels."

President Truman was asked if FPC's ruling conflicted with views he expressed on vetoing the Harris-Kerr amendment to the Natural Gas Act, which would have exempted production and gathering from FPC jurisdiction. The President said he saw no conflict; that FPC presumably decides cases on evidence before it. In vetoing the Harris-Kerr bill, he had said it would have left consumers without protection from unreasonable rate increases. Truman also told reporters that Mon Wallgren would retire as FPC chairman upon completing some pending business. Wallgren had stated previously that he planned to leave FPC.

Immediately following the decision in the Phillips case, FPC on July 20 issued a statement expressing hope Congress would pass "remedial" legislation that would take away some of its present powers, removing intrastate natural gas pipe lines from its jurisdiction. This attitude is a reversal of that taken by FPC last year when it initiated the East Ohio Gas Company case, contending it could regulate the activities of that company, an intrastate operator. In this contention FPC was upheld by the U. S. Supreme Court. But now FPC says it does not want jurisdiction over intrastate lines. Its views were expressed in an opinion involving five intrastate Illinois lines which are customers of Texas Illinois Natural Gas Pipe Line Company. FPC explains that it must take jurisdiction in this case because it is bound by the East Ohio decision. But there seems to be "no good reason," declared FPC, for subjecting the five Illinois lines to federal as well as state controls, "save only the controlling legal fact that the natural gas act, as construed by the courts apparently affords no alternative."

Unused Production Capacity Is Million Barrels Daily

At the beginning of this year there was in the world an unused petroleum production capacity of 1,040,000 barrels daily, including 835,000 daily in the U. S. and 205,000 daily in other countries.

This is one of the facts revealed in the report given to the Department of the Interior in late July by the National Petroleum Council, covering the findings of its Committee on Oil and Gas Availablity, headed by L. F. McCollum, president of Continental Oil Company.

Domestic availability of petroleum liquids by 1955 will be in a range from 7,789,000 to 8,838,000 barrels daily, or 32 to 50 percent above actual production of 5,900,000 barrels daily in 1950, the committee estimated, assuming conditions favorable to continued development. By 1955, availability in the rest of the world outside Russia and satellites will be in range from 6,092,000 to 7,139,000 barrels daily, compared with an indicated productive capacity last January of 4,703,000 daily, the committee estimated.

Covering only the next five years, 1951-1955, the report also forecast an increase in natural gas availability in the U. S. to a range of 9.5 to 11.9 trillion cubic feet annually in 1955 from 8.1 to 9.5 trillion cubic feet in 1951.

House Starts Tidelands Bill On Its Way to Truman Veto

Despite virtual certainty of a veto if enacted, the House of Representatives in late July was due to begin debate soon on a bill quitclaiming offshore submerged lands to adjoining coastal states. States would be given clear title to a belt three miles out from low tide mark, and Texas' traditional claim to 10½ miles out would be confirmed.

The Senate's Interior Committee is expected to report to the Senate a bill providing "interim" control of the offshore lands by the different states, pending Congressional settling of federal-state dispute over title. Senator O'Mahoney, D., Wyo., chairman of the committee, apparently is in the minority in favoring a bill that would give interim control to the U. S. government.

Pipe Line Expansion Need Cited in PAD Steel Report

The need for rapid expansion of the nation's crude oil pipe line network was singled out by Petroleum Administration for Defense in its recommendations for fourth quarter allocation of 2,336,470 tons of steel for domestic oil and gas operations and for Canadian and other foreign programs incidental to meeting U. S. demand.

Military and Iranian developments make it essential, PAD stated, that early steps be taken to move crude from sections with excess productive capacity to refinery centers. With crude and condensate production this year running 23 percent ahead of 1950, pipe line deliveries to refineries have been boosted 24 percent, and at present no excess line capacity exists.

PAD requested 1,200,474 tons of line pipe for the three months commencing with October, of which 1,132,940 tons would be allocated for domestic operations, including production. The agency made the following specific recommendations for expanding pipe lines as the most essential for getting additional crude for the defense effort:

● There is a greater need for pipe line capacity from West Texas, the area of first reliance for furnishing increased quantities of crude. Two large diameter lines are scheduled to be built from the area, including the recently announced Rancho Pipe Line System with initial capacity of 209,000 barrels a day, to be constructed by Shell Pipe Line Corporation and five other participants. This 24-inch line will extend from McCamey in the Permian Basin, 477 miles to Houston refineries.

● The Rocky Mountain region is capable of producing more crude, but PAD noted the one existing line from the area into the Mid-Continent has insufficient capacity for additional oil. Completion of the 1080-mile Platte Pipe Line from Worland, Wyo., to Wood River, Ill., will require considerable tonnage of pipe. Construction on this line, a joint venture of British-American Oil Company, Continental Oil Company, The Ohio Oil Company, The Pure Oil Company and Sinclair Refining Company, has moved slowly because of the tight pipe supply.

● Louisiana production also is handicapped by lack of crude oil pipe line outlets.

● Ohio Oil recently completed a 20 and 22-inch line between Wood River and Sheridan, Ind., but needs 117 miles of pipe to extend the line to Lima, Ohio. It is highly important that this extension be made to meet the greater crude oil requirements of refineries in the Great Lakes area, PAD stated.

● Sinclair Pipe Line Company operates an extensixe pipe line system consisting of many parallel small diameter lines between Drumright, Okla., and East Chicago, Ind. This system is old and incapable of handling increased volume of crude, PAD pointed out. This line must be replaced with larger diameter pipe; and the work must be started in 1951, if it will be available for service in 1952, the agency stated.

● Several important products lines must be started in 1951 to provide increased means of distribution of finished products for refineries to consuming areas.

Line Pipe Lack Threatens PAD Ban on Gas for East

Petroleum Administration for Defense's controversial move to ban natural gas to new customers in the East, while cramping the expansion plans of transmission firms, distributors and gas appliance manufacturers, grows out of a well-intended plan to head off extra demand for gas that suppliers might be unable to fulfiill because of lack of large diameter line pipe for completing expansion projects.

Such pipe is one of the most critically short steel items needed for oil and gas operations. Large-size pipe is made from plate, which also is the essential steel required by the military and a large number of defense-supporting industries. Defense Production Administration metal officials forecast that total production of steel plate in the fourth quarter will approximate 2,480,000 tons, compared to total demand in excess of 3 million tons.

Regardless of the sharp criticism that PAD has been discriminatory in its allocation of pipe to the gas branch, line pipe deliveries to the industry in the third quarter are expected to amount to only about one-half of the allocation of 500,000 tons. To make up part of the deficit, PAD has requested 609,500 tons of pipe for the gas branch during the final three months of the year, which the agency states represents the minimum tonnage to complete projects to critical areas. This allocation, if granted by DPA, would be divided 420,850 tons for transmission lines, 140,400 tons for local disrtibution systems, and 42,250 tons for MRO (maintenance, repair and operating) use.

Such an increase in allocation still will be short of the needs of the gas branch to keep pace with its proposed 1951 expansion, which as approved by the Federal Power Commission totals an expenditure of $630 million for 7618 miles of new lines. PAD estimates actual fourth quarter pipe requirements of the gas branch are in excess of 1 million tons based on the projected construction as well as slippage in deliveries in each quarter of this year. The gas branch also will require a "sizable" tonnage allocation for the first quarter of 1952, according to PAD.

Gas Utility Industry Plans $1500 Million Expenditure

The gas utility industry plans to spend this year a record-setting $1500 million for construction of new pipe lines and other facilities and replacement of old equipment. This is the revised estimate of the American Gas Association, following a recent survey It exceeds previous estimates and compares with $1200 million spent last year.

The survey showed also that the gas industry expects to spend $4590 million for construction and expansion of facilities in the five years, 1951-1955, compared with $3990 million during the past five years. The projected expenditures include $1500 million in 1951, $1338 million in 1952, $707 million in 1953, $553 million in 1954, and $492 million in 1955.

About $2400 million or over half the projected construction expendi-

tures for the next five years will be spent on natural gas transmission pipe lines, $1200 million on distribution lines, and less than $400 million for construction of facilities for all other types of gas, including manufactured, mixed, and liquefied petroleum.

The gas industry can fulfill these plans, however, only if it can secure adequate supplies of steel pipe and other critical materials.

To finance the large expansion program, the gas companies will raise $3200 million through sale of securities, including $900 million in common and preferred stocks. The remaining $1400 million probably will be supplied from internal capital generated by the industry, including accrued earnings.

Economical Extraction of Oils From Tar Sands Likely

A new chemical process promises commercial, economical extraction of oil from tar sands, such as those in the Athabaska deposit of Alberta. At atmospheric conditions, a chemical reaction is set up within the mass of oil and sand which causes almost instantaneous separation. No foreign matter is introduced which would have to be removed through further treatment. In a demonstration in a clear glass tumbler, oil can be seen to separate and float to the surface, while the sand drops to the bottom.

Need Cited for Continued Top Output in California

All-out California petroleum production still will be required even if cease-fire negotiations result in actual cessation of hostilities in Korea. This will be necessary, according to Charles S. Jones, president of Richfield Oil Corporation, in order to restore the balance with normal civilian demand.

"But whether we may have an easier supply situation in the next few months will, in that event, depend upon whether the accelerated civilian demand declines," Jones observed. "Personally, I do not think it will."

Commenting on the long range supply of gasoline, Jones said sufficient raw material, in one form or another, is in sight to supply all the gasoline requirements for a thousand years or so.

Jones pointed out that military demand supplied from the California area during April of this year was up 78 percent from that of April, 1950. Civilian demand during the same period increased 12.7 percent.

California Able to Supply Emergency Oil, Says Agency

In the next five years, 1951-1955, California fields can supply civilian oil demand plus 130,000 barrels daily for emergency use or 267,000 daily by including normal oil receipts of oil from fields outside the state and output of the naval petroleum reserve at Elk Hills.

These estimates were made by the Oil Producers Agency of California in studying proposals to build pipe lines for bringing in oil from sources outside the state. The agency also estimated that 1⅔ barrels per day of production can be obtained per ton of steel used for drilling oil wells in California, against an estimate for one proposed pipe line of 1½ barrels oil daily delivered in California per ton of steel usd.

Larger Capacity Foreseen For Interprovincial Line

An early increase is indicated in the capacity of Interprovincial Pipe Line Company's crude line from Edmonton in Western Canada to Superior, Wis. The need is foreseen because of current increased demands and the international situation which may require a stepup of production in the Western Hemisphere.

Interprovincial's system, first major trunk pipe line constructed in Canada, was built to move more than 100,000 barrels of crude daily from the Prairie Provinces of Canada and is already being strained to serve seven refineries in the Dominion and to build up its stocks at Superior.

New tankage is being erected at both Edmonton and Superior and plans are being made to build additional pump stations. The line was built with sufficient flexibility to take care of anticipated expansion requirements.

Present storage at the Superior end of the line is 1,800,000 barrels and current construction will increase storage capacity by 2,600,000 barrels, thus making available storage for 4,400,000 barrels by the spring of 1952.

Completion of the project, however, depends on steel availability.

Interprovincial supplies crude to seven Canadian refineries and a refinery at Superior, Wis. The average volume of crude being moved out of Edmonton is slightly in excess of 96,000 barrels daily, of which 55,000 barrels is for storage at the Superior tank farm. This supply is being tapped almost daily by tankers plying Lake Superior, through the Straits at Sault Ste. Marie and down Lakes Huron and Erie to destinations.

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Montana Well Arouses New Interest in Williston Basin

Interest in the Williston Basin as a potential important new oil province was heightened last month by flow of 38-gravity oil from the Madison formation on a drill-stem test at 7183-7253 feet in Shell Oil Company's Northern Pacific Railroad 1, in 19-23n-50e, northwestern corner of Dawson County, eastern Montana.

Projected as an 11,000-foot Ordovician test, the well is about 100 miles southwest of Amerada Petroleum Corporation's North Dakota wildcat producer from Devonian at 11,630-60 feet. Shell's Northern Pacific well is one of more than a half dozen wildcats now drilling in the western part of the Williston Basin in eastern Montana and adjacent Saskatchewan Province, Canada.

Carbonated Water May Increase Oil Recovery

Carbonated water has a new significance for oil men. Small amounts of carbon dioxide diluted in water and injected into depleted oil sands are proving effective in secondary recovery operations, and research reveals that more favorable reactions can be achieved than by using ordinary injection water. (See article, page 179.)

In a recent report to the Interstate Oil Compact Commission, James W. Martin, consulting engineer, Oil Recovery Corporation, New York, declared that by treating an oil sand with a relatively small solution of carbon dioxide in water or brine, more oil may be recovered than is possible with ordinary water or gas drive.

Because of its apparent action in increasing water injectivity rates the use of carbon dioxide may prove extremely important in recovering oil from tight, high temperature sands.

Continuing Strong Demand Requires Sustained Operations

By L. J. LOGAN, WORLD OIL Staff

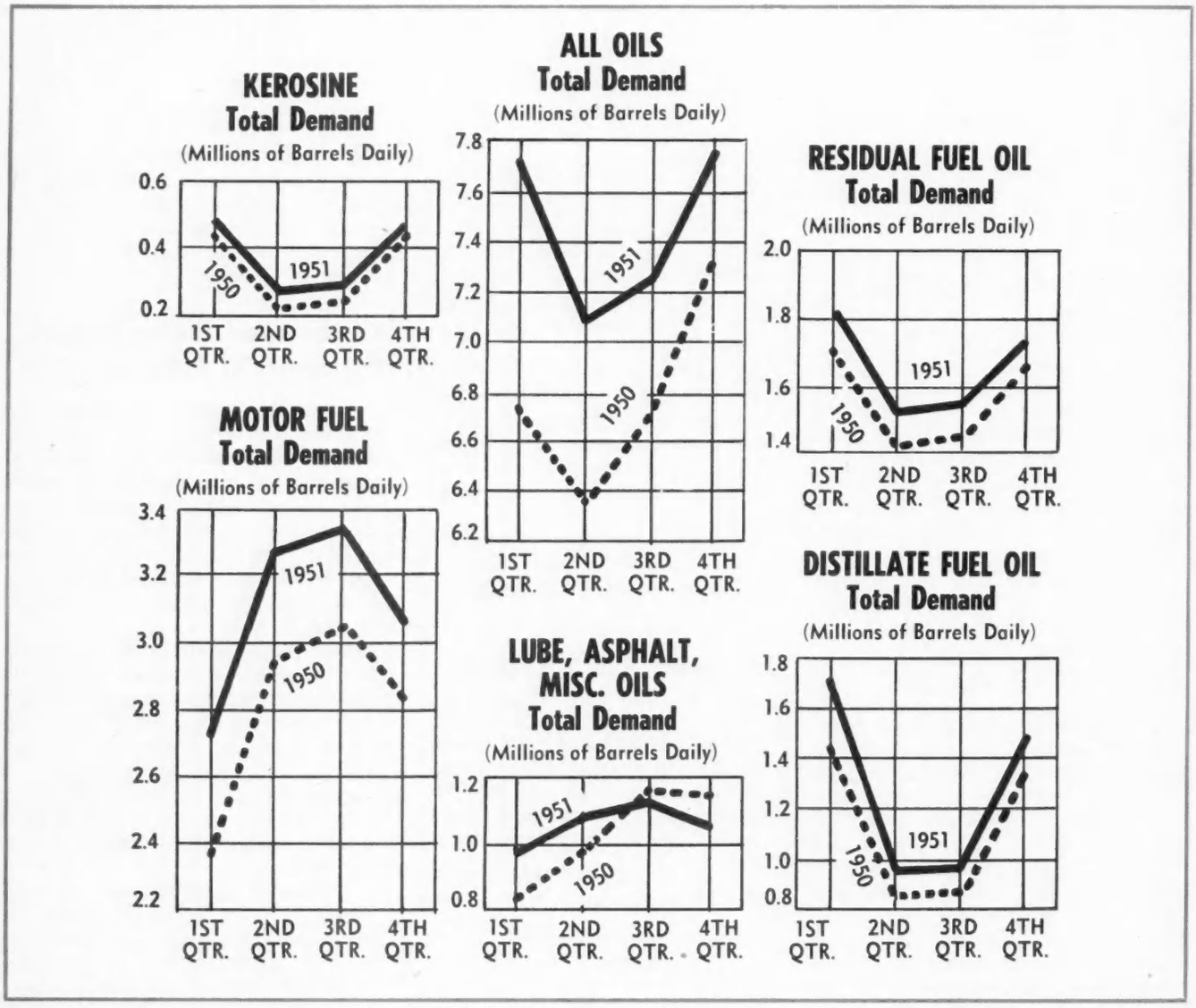
OPERATIONS of the U. S. petroleum industry must continue in the latter half of 1951 around or above the high levels of the first half in order to meet the indicated requirements. This is the outlook as foreseen by the Bureau of Mines in its revised forecast for this year, embodied in its Monthly Petroleum Forecast No. 191, covering June.

Total demand for all oils will average 7,500,000 barrels per day in the second half of 1951, or almost 100,000 barrels a day more than the demand of 7,403,000 daily in the first half.

With demand thus somewhat exceeding recent levels, it is indicated that the demand for domestic crude production will average 6,005,000 barrels daily in the second half of 1951, or nearly as much as the 6,022,000 daily recorded in the first half.

Crude runs to stills will be up somewhat to 6,431,000 barrels daily in the latter half of this year from 6,411,000 daily in the initial half, to meet larger demand. But relatively more of the crude consumed at refineries will be from foreign fields, with crude imports forecast at 560,000 barrels daily in the second half, compared with 514,000 daily in the first half.

Holding down the demand for either domestic or imported crude will be a further increase in the rate of production of natural gasoline and other light hydrocarbons in the U. S. This production is expected to average about 567,000 barrels daily in the last six months of 1951, compared



with 551,000 daily in the first six months. In the fourth quarter the output is forecast at 587,000 barrels daily, a comparatively large volume of oils.

Also acting as a brake on the demand for both domestic and imported crude oil is the prospect of somewhat higher imports of refined products, which are estimated at 413,000 barrels daily for the second half of 1951, compared with 398,000 daily in the first half. The product imports are mostly fuel oils and will be stepped up to 446,000 barrels daily average in the fourth quarter from 381,000 daily in the third quarter.

Finally, domestic crude production may be slightly less in the latter half of 1951 than in the first half in spite of higher total demand for all oils for the reason that less may be produced for storage of either crude or products. For the second half, the Bureau of Mines has not made allowance for any further additions to crude stocks, which were at desirable levels at midyear; and additions to stocks of refined products were forecast at an average of 45,000 barrels daily for the second half. In the first half of this year, domestic crude production more substantially exceeded current oil consumption, as crude stocks were increased 28,000 barrels per day, while stocks of refined products were expanded 81,000 barrels daily, a total addition of 109,000 barrels per day to the stocks of all oils.

Total demand for all oils will be higher in the second half of 1951 than

Revised Forecast of Petroleum Demand and Supply in 1951, Compared with 1950

(All Data from U. S. Bureau of Mines)
(THOUSANDS OF BARRELS)

ITEM	FIRST HALF			SECOND HALF			YEAR			1951	
	1950	1951	% Diff.	1950	1951	% Diff.	1950	1951	% Diff.	3rd Qtr.	4th Qtr.
DEMAND											
All Oils, Total Demand	**1,190,358**	**1,340,000**	**+ 12.6**	**1,292,742**	**1,380,000**	**+ 6.7**	**2,483,100**	**2,720,000**	**+ 9.5**	**666,000**	**714,000**
(Daily Average)	6,576	7,403	+ 12.6	7,026	7,500	+ 6.7	6,803	7,452	+ 9.5	7,239	7,761
Domestic Demand	1,138,337	1,288,000	+ 13.1	1,233,863	1,332,000	+ 7.9	2,372,200	2,620,000	+ 10.4	641,000	691,000
(Daily Average)	6,289	7,116	+ 13.1	6,706	7,239	+ 7.9	6,499	7,178	+ 10.4	6,967	7,511
Exports, Total	52,021	52,000	— 0.0	58,879	48,000	— 18.5	110,900	100,000	— 9.8	25,000	23,000
(Daily Average)	287	287	— 0.0	320	261	— 18.5	304	274	— 9.9	272	250
Crude Exports	15,619	15,000	— 4.0	19,181	12,000	— 37.4	34,800	27,000	— 22.4	6,000	6,000
(Daily Average)	86	83	— 4.0	104	65	— 37.4	95	74	— 22.4	65	65
Refined Products	36,402	37,000	+ 1.6	39,698	36,000	— 9.3	76,100	73,000	— 4.1	19,000	17,000
(Daily Average)	201	204	+ 1.6	216	196	— 9.3	209	200	— 4.1	207	185
Motor Fuel Demand	**480,245**	**543,000**	**+ 13.1**	**538,755**	**590,000**	**+ 9.5**	**1,019,000**	**1,133,000**	**+ 11.2**	**307,000**	**283,000**
(Daily Average)	2,653	3,000	+ 13.1	2,928	3,207	+ 9.5	2,792	3,104	+ 11.2	3,337	3,076
Domestic Demand	468,404	531,000	+ 13.4	526,096	579,000	+ 10.0	994,500	1,110,000	+ 11.6	301,000	278,000
(Daily Average)	2,588	2,934	+ 13.4	2,859	3,147	+ 10.0	2,725	3,041	+ 11.6	3,272	3,022
Exports	11,841	12,000	+ 1.3	12,659	11,000	— 13.1	24,500	23,000	— 6.1	6,000	5,000
(Daily Average)	65	66	+ 1.3	69	60	— 13.1	67	63	— 6.1	65	54
Kerosine Demand	**57,840**	**67,000**	**+ 15.8**	**62,060**	**66,000**	**+ 6.3**	**119,900**	**133,000**	**+ 10.9**	**26,000**	**40,000**
(Daily Average)	319	370	+ 15.8	337	359	+ 6.3	328	364	+ 10.9	283	435
Domestic Demand	56,899	66,000	+ 16.0	61,001	65,000	+ 6.6	117,900	131,000	+ 11.1	25,500	39,500
(Daily Average)	314	365	+ 16.0	331	353	+ 6.6	323	359	+ 11.1	277	429
Exports	941	1,000	+ 6.3	1,059	1,000	— 5.6	2,000	2,000	.....	500	500
(Daily Average)	5	5	+ 6.3	6	6	— 5.6	5	5	....	6	6
Distillate Demand	**205,151**	**242,000**	**+ 18.0**	**202,149**	**223,000**	**+ 10.3**	**407,300**	**465,000**	**+ 14.2**	**88,000**	**135,000**
(Daily Average)	1,133	1,337	+ 18.0	1,099	1,212	+ 10.3	1,116	1,274	+ 14.2	957	1,468
Domestic Demand	199,105	236,000	+ 18.5	195,595	217,000	+ 10.9	394,700	453,000	+ 14.8	85,000	132,000
(Daily Average)	1,100	1,304	+ 18.5	1,063	1,179	+ 10.9	1,081	1,241	+ 14.8	924	1,435
Exports	6,046	6,000	— 0.8	6,554	6,000	— 8.5	12,600	12,000	— 4.8	3,000	3,000
(Daily Average)	33	33	— 0.8	36	33	— 8.5	35	33	— 4.8	33	33
Residual Demand	**282,690**	**303,000**	**+ 7.2**	**286,510**	**300,000**	**+ 4.7**	**569,200**	**603,000**	**+ 5.9**	**141,000**	**159 000**
(Daily Average)	1,562	1,674	+ 7.2	1,557	1,630	+ 4.7	1,560	1,652	+ 5.9	1,532	1,728
Domestic Demand	274,616	296,000	+ 7.8	278,284	293,000	+ 5.3	552,900	589,000	+ 6.5	137,000	156,000
(Daily Average)	1,517	1,635	+ 7.8	1,512	1,592	+ 5.3	1,515	1,614	+ 6.5	1,489	1,696
Exports	8,074	7,000	— 13.3	8,226	7,000	— 14.9	16,300	14,000	— 14.1	4,000	3,000
(Daily Average)	45	39	— 13.3	45	38	— 14.9	45	38	— 14.1	43	32
Other Oils Demand*	**164,432**	**185,000**	**+ 12.5**	**203,268**	**201,000**	**— 1.1**	**367,700**	**386,000**	**+ 5.0**	**104,000**	**97,000**
(Daily Average)	909	1,022	+ 12.5	1,105	1,092	— 1.1	1,007	1,058	+ 5.0	1,130	1,054
Domestic Demand	139,313	159,000	+ 14.1	172,887	178,000	+ 2.9	+ 312,200	337,000	+ 7.9	92,500	85,500
(Daily Average)	770	878	+ 14.1	940	967	+ 2.9	855	923	+ 7.9	1,005	929
Exports	25,119	26,000	+ 3.5	30,381	23,000	— 24.3	55,500	49,000	— 11.7	11,500	11,500
(Daily Average)	139	144	+ 3.5	165	125	— 24.3	152	134	— 11.7	125	125
STOCKS CHANGE											
All Oils	**—44,124**	**+19,700**	.....	**+23,724**	**+ 8,300**	.....	**—20,400**	**+28,000**	.....	**+23,300**	**—15 000**
(Daily Average)	—244	+109	.....	+129	+45	.....	—56	+77	.....	+253	—163
Crude Oil	—11,069	+5,000	.....	+6,169	.....	.....	—4,900	+5,000	.....	.....	.....
(Daily Average)	—61	+28	.....	+34	.....	.....	—13	+14	.....	.....	.....
Other Oils	—33,055	+14,700	.....	+17,555	+8,300	.....	—15,500	+23,000	.....	+23,300	—15,000
(Daily Average)	—183	+81	.....	+95	+45	.....	—43	+63	.....	+253	—163
NEW SUPPLY											
Total New Supply	**1,146,234**	**1,359,700**	**+ 18.6**	**1,316,466**	**1,388,300**	**+ 5.5**	**2,462,700**	**2,748,000**	**+ 11.6**	**689,300**	**699,000**
(Daily Average)	6,333	7,512	+ 18.6	7,155	7,545	+ 5.5	6,747	7,529	+ 11.6	7,492	7,598
Domestic Production	**998,527**	**1,194,700**	**+ 19.6**	**1,155,073**	**1,209,300**	**+ 4.7**	**2,153,600**	**2,404,000**	**+ 11.6**	**603,300**	**606,000**
(Daily Average)	5,517	6,601	+ 19.6	6,278	6,572	+ 4.7	5,900	6,586	+ 11.6	6,558	6,587
Crude Oil	912,701	1,095,000	+ 20.0	1,059,199	1,105,000	+ 4.3	1,971,900	2,200,000	+ 11.6	553,000	552,000
(Daily Average)	5,043	6,050	+ 20.0	5,757	6,005	+ 4.3	5,402	6,027	+ 11.6	6,011	6,000
Other Oils	85,826	99,700	+ 16.2	95,874	104,300	+ 8.8	181,700	204,000	+ 12.3	50,300	54,000
(Daily Average)	474	551	+ 16.2	521	567	+ 8.8	498	559	+ 12.3	547	587
Imports, Total	**147,707**	**165,000**	**+ 11.7**	**161,393**	**179,000**	**+ 10.9**	**309,100**	**344,000**	**+ 11.3**	**86,000**	**93,000**
(Daily Average)	816	912	+ 11.7	877	973	+ 10.9	847	943	+ 11.3	935	1,011
Crude Oil	85,100	93,000	+ 9.3	92,600	103,000	+ 11.2	177,700	196,000	+ 10.3	51,000	52,000
(Daily Average)	470	514	+ 9.3	503	560	+ 11.3	487	537	+ 10.3	554	565
Refined Products	62,607	72,000	+ 15.0	68,793	76,000	+ 10.5	131,400	148,000	+ 12.6	35,000	41,000
(Daily Average)	346	398	+ 15.0	374	413	+ 10.5	360	406	+ 12.6	381	446
Crude Runs to Stills	**981,301**	**1,160,401**	**+ 18.2**	**1,113,566**	**1,183,264**	**+ 6.3**	**2,094,867**	**2,343,665**	**+ 11.9**	**591,600**	**591,800**
(Daily Average)	5,422	6,411	+ 18.2	6,052	6,431	+ 6.3	5,739	6,421	+ 11.9	6,430	6,433
Demand Domestic Crude	**924,064**	**1,090,000**	**+ 18.0**	**1,053,971**	**1,105,000**	**+ 4.8**	**1,978,035**	**2,195,000**	**+ 11.0**	**553,000**	**552,000**
(Daily Average)	5,105	6,022	+ 18.0	5,728	6,005	+ 4.8	5,419	6,014	+ 11.0	6,011	6,000

* Includes liquefied gases, petroleum coke, asphalt, road oil, lubricants, crude as fuel, refinery losses, etc.

in the first half in spite of the fact exports are expected to be down to 261,000 barrels daily from 287,000 per day. Domestic demand is forecast at 7,239,000 barrels daily, compared with 7,116,000 daily in the first half. The moderately higher total demand for all oils in the second half will reflect a seasonal increase for gasoline somewhat outweighing seasonal decreases for the fuel oils and kerosine. Data by quarters for 1951 indicate total demand for all oils averaging 7,737,000 barrels daily in the first quarter, 7,073,000 daily in the second quarter, 7,239,000 daily in the third quarter, and a peak of 7,761,000 daily in the fourth quarter. This indicates an average of 7,452,000 barrels per day of total demand for all oils for the whole year 1951, an increase of 9.5 percent over the 6,803,000 daily for 1950.

In this year's first six months the average total demand was 7,403,000 barrels daily, an increase of 12.6 percent over the 6,576,000 daily in the first half of 1950. For the latter half of 1951 the estimated total demand averages 7,500,000 barrels daily, an increase of 6.7 percent over the 7,026,000 daily of the latter half of 1950. The lower gain over a year ago for the second half than for the first half reflects the sharp increase in demand for petroleum as well as most other products in the latter half of 1950, following outbreak of the Korean War.

While total demand for all oils will be 6.7 percent greater in this year's second half than in last year's closing six months, the increase in domestic demand will be 7.9 percent, it is estimated, while exports will be off 18.5 percent, with shipments down sharply for crude but off more moderately for each of the refined products.

Holding down the increase in second-half demand over last year will be only moderate gains for residual fuel oil and kerosine, in contrast with increases of around 10 percent for gasoline and distillate fuel oil.

Total demand for motor fuel in the second half of 1951 will be 9.5 percent greater than in the latter half of 1950, according to the forecast, with domestic demand up 10 percent and exports down somewhat. This trend of demand would result in an increase of 11.2 percent for the year as a whole.

Distillate fuel oil total demand is expected to be 10.3 percent greater this year than last year for the closing six months, with domestic consumption up 10.9 percent and exports down nominally. This would be a considerably smaller increase than that of 18.0 percent shown for the first half of 1951, but would still result in an increase of 14.2 percent for the year as a whole.

Kerosine total demand is forecast at 6.3 percent more for the second half of 1951 than in the like period of 1950, with domestic use up 6.6 percent and exports down slightly. As demand was up sharply by 15.8 percent for the first six months, this year as a whole is expected to show an increase of 10.9 percent.

Total demand for residual fuel oil in the second half has been estimated at 4.7 percent above last year, with domestic consumption placed 5.3 percent higher and exports somewhat lower. As residual demand was 7.2 percent above 1950 for the first six months, an increase of 5.9 percent is indicated for this year as a whole.

Total demand for all other oils showed an increase of 12.5 percent over 1950 for the first half, but may be off about 1.1 percent in the second half, due to sharply lower exports of crude, holding the increase for the year to about 5 percent.

Stocks of Crude Petroleum in U. S., By Grades at End of June, 1950-1951
Based on Weekly Reports of U. S. Bureau of Mines
(THOUSANDS OF BARRELS)

	July 1, 1950	June 30, 1951	Change
Pennsylvania Grade	2,884	2,090	— 794
Other Appalachian	1,578	1,471	— 107
Lima-Michigan	813	709	— 104
Illinois-Indiana	8,021	10,327	+2,306
Arkansas	3,071	2,879	— 192
Kansas	8,226	9,630	+1,404
Louisiana	15,536	14,068	—1,468
Northern	3,765	2,895	— 870
Gulf Coast	11,771	11,173	— 598
Mississippi	2,176	3,076	+ 900
New Mexico	5,894	6,742	+ 848
Oklahoma	25,899	27,283	+1,384
Texas	112,399	116,912	+4,513
East Texas	15,787	15,112	— 675
West Texas	41,952	48,413	+6,461
Gulf Coast	27,221	25,527	—1,694
Other Texas	27,439	27,860	+ 421
Panhandle	3,994	4,160	+ 166
North	7,617	8,102	+ 485
South	6,902	6,108	— 794
Other	8,926	9,490	+ 564
Rocky Mountain	12,646	13,819	+1,173
California	35,495	30,493	—5,002
Foreign	6,305	8,007	+1,702
Total Crude Stocks in U.S.	240,943	247,506	+6,563

U. S. Crude Runs to Stills, Refining Capacity and Stocks of Major Products, by Districts
Data from Bureau of Mines, except May and June, 1951, and refinery capacities from API. Stocks are those at refineries, at bulk terminals, in transit and in pipe lines.
(THOUSANDS OF BARRELS)

	CRUDE RUNS TO REFINERY STILLS													STOCKS OF MAJOR REFINED PRODUCTS							
	Capacity and Runs in June								Runs in First 6 Months					Gasoline (Finished and Unfinished)		Kerosine		Distillate Fuel Oil		Residual Fuel Oil	
	Daily Capacity			Daily Runs			Percent Capacity Used		Total Amt. Run		Daily Runs			Stocks End of June		Stocks End of June		Stocks End of June		Stocks End of June	
REFINING DISTRICT	June 1950	June 1951	Perct. Diff.	June 1950	June 1951	Perct. Diff.	June 1950	June 1951	6 Mo. 1950	6 Mo. 1951	6 Mo. 1950	6 Mo. 1951	Perct. Diff.	1950	1951	1950	1951	1950	1951	1950	1951
East Coast	1,006	1,047	+4.1	923	1,056	+14.4	91.7	100.9	156,101	183,501	862	1,014	+17.6	25,873	27,808	7,274	9,479	13,993	19,691	10,031	9,668
Appalachian	191	194	+1.6	164	183	+11.6	85.9	94.3	29,244	32,410	162	179	+10.0	3,352	4,400	412	814	572	1,157	423	553
Dist. 1	117	116	—0.9	93	105	+12.9	79.5	90.5	16,642	18,533	92	102	+11.4	2,367	3,015	324	523	430	776	261	313
Dist. 2	74	78	+5.4	71	78	+ 9.9	95.9	100.0	12,602	13,877	70	77	+10.1	985	1,385	88	291	142	381	162	240
Ind.-Ill.-Ky.	1,171	1,249	+6.7	1,042	1,226	+17.7	89.0	98.2	180,784	217,071	999	1,199	+20.1	22,948	28,296	4,204	4,707	8,278	13,984	3,533	4,284
Okla.-Kans.-Mo.	557	579	+3.9	502	542	+ 8.0	90.1	93.6	83,009	95,326	459	527	+14.8	11,846	14,508	945	1,358	5,251	7,808	1,196	1,504
Texas Inland	286	258	—9.8	209	254	+21.5	73.1	98.4	36,602	42,754	202	236	+16.8	3,298	3,420	410	442	965	1,204	737	822
Texas Gulf	1,592	1,579	—0.8	1,189	1,570	+32.0	74.7	99.4	215,623	281,093	1,191	1,553	+30.4	16,851	18,511	3,539	4,167	7,879	8,018	4,140	4,547
La. Gulf	474	499	+5.3	456	493	+ 8.1	96.2	98.8	81,173	88,510	449	489	+ 9.0	5,762	6,509	2,612	2,096	3,319	3,654	1,868	1,720
N. La.-Ark.	86	86	.....	68	74	+ 8.8	79.1	86.0	12,501	14,114	69	78	+12.9	2,305	2,513	351	350	566	742	154	89
Rocky Mtns.	252	257	+2.0	211	247	+17.1	83.7	96.1	33,647	41,066	186	227	+22.0	4,770	5,448	403	306	1,541	1,568	688	1,086
Dist. 3	17	16	—5.9	14	13	— 7.1	82.4	81.2	2,412	2,533	13	14	+ 5.0	123	106	25	.....	22	59	35	31
Dist. 4	235	241	+2.6	197	234	+18.8	83.8	97.1	31,235	38,533	173	213	+23.4	4,647	5,342	378	306	1,519	1,509	653	1,055
California	1,101	1,179	+7.1	891	926	+ 3.9	80.9	78.6	152,617	170,507	843	942	+11.7	17,069	15,431	967	423	11,315	7,874	17,355	16,824
Total U. S.	6,716	6,927	+3.1	5,655	6,571	+16.2	84.2	94.9	981,301	1,166,352	5,422	6,444	+18.9	114,074	126,844	21,117	24,142	53,679	65,700	40,124	41,097

WORLD OIL Predicts:

44,965 New Wells This Year

By WARREN L. BAKER and CECIL W. SMITH
WORLD OIL Staff

MORE wells, more wildcats, more footage than ever before are the drilling marks indicated by WORLD OIL's midyear survey.

The total of 44,965 new wells forecast for 1951 represents an increase of only 20 wells over the estimate made by WORLD OIL at the beginning of the year. However, the revised forecast contains many changes in number of wells which will be drilled in the various states and districts.

The 44,965 new wells forecast for the year compare with 43,203 in 1950, and with a program calling for 43,400 by the Petroleum Administration for Defense. This new total would top the 1950 record number by slightly more than 4 percent.

The revised forecast also indicates an increase in wildcats over that predicted at the first of the year. A total of 9139 wildcats now estimated for 1951 compares with a first-of-the-year forecast of 8363 wildcats. The new wildcatting forecast represents 20.3 of the total drilling, an all-time high. This is in line with the upward trend reflected in drilling operations in recent years. In 1950, wildcatting accounted for 18.5 percent of total drilling, while a year earlier it amounted to only 17.9 percent. This upward trend in exploration has pre-

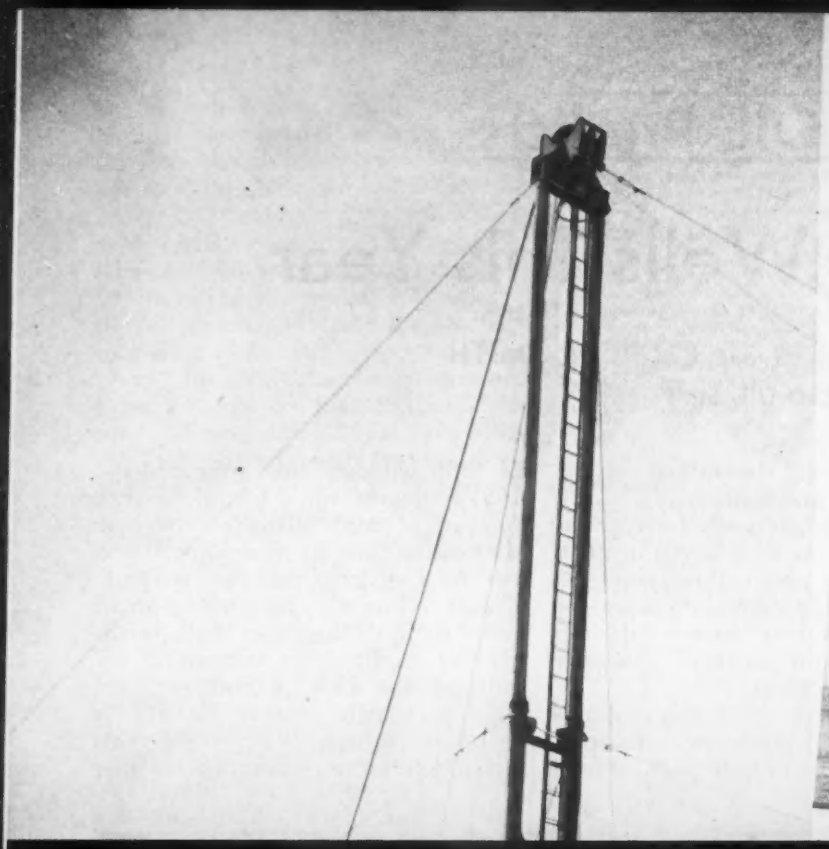
Indicated Number of Wells and Footage to Be Drilled in 1951

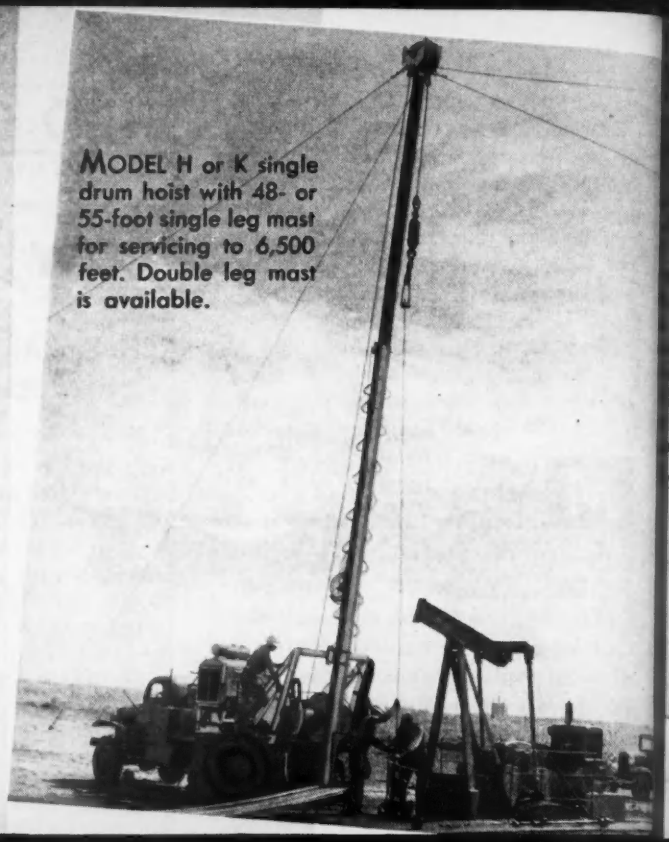
Forecast covers all new wells to be drilled for oil or gas in 1951, salt-water disposal wells, and water or gas-input wells for repressuring and secondary recovery, but does not estimate old wells drilled deeper.

STATE or DISTRICT	NEW WELLS			WILDCAT TESTS		FOOTAGE[1]			
	Forecast, 1951	Drilled, 1950	Percent Change	Forecast, 1951	Percent New Wells	To Be Drilled, 1951	Drilled, 1950	Percent Change From 1950	Percent of U.S. Total 1951
Alabama	65	45	+ 44.4	22	33.8	316,615	198,313	+ 59.7	0.18
Arkansas	387	397	— 2.5	86	22.2	1,327,209	1,327,747	+ 2.2	0.79
California	2,458	1,791	+ 37.2	508	20.7	9,694,352	7,655,668	+ 26.6	5.64
Colorado	256	87	+ 194.3	130	50.8	1,250,816	390,713	+ 220.1	0.73
Florida	4	11	— 63.6	4	100.0	25,600	69,518	— 63.2	0.01
Illinois	2,510	2,910	— 13.8	690	2.75	6,440,660	6,408,293	+ 0.5	3.75
Indiana	1,182	1,547	— 23.6	382	32.3	2,137,056	2,669,132	— 19.9	1.24
Kansas	4,403	3,998	+ 10.1	1,019	23.1	14,970,200	12,907,790	+ 16.0	8.71
Kentucky	1,300	1,247	+ 4.3	205	15.8	2,607,800	2,332,617	+ 11.8	1.52
Louisiana	2,189	2,444	— 10.4	339	15.5	13,768,266	14,789,620	— 6.9	8.01
North Louisiana	1,226	1,311	— 6.5	216	17.6	4,696,806	4,674,257	+ 0.5	2.73
South Louisiana	963	1,133	— 15.0	123	12.8	9,071,460	10,115,363	— 10.3	5.28
Maryland	63	4	+1475.0	1	1.6	245,574	16,636	+1376.2	0.14
Michigan	753	829	— 9.2	327	43.4	2,935,194	2,050,324	+ 43.2	1.71
Mississippi	322	322	.....	133	41.3	2,202,802	2,330,060	— 5.5	1.28
Montana	342	268	+ 27.6	64	18.7	755,478	667,798	+ 13.1	0.44
Nebraska	144	107	+ 34.6	58	40.3	661,680	464,024	+ 42.6	0.39
New Mexico	690	593	+ 16.4	105	15.2	3,308,550	2,666,843	+ 24.1	1.92
New York	750	723	+ 3.7	....	....	1,326,000	1,056,985	+ 25.5	0.77
North Dakota	16	3	+ 433.3	15	93.8	89,600	27,062	+ 231.1	0.05
Ohio	848	970	— 12.6	30	3.5	1,732,464	2,037,400	— 15.0	1.01
Oklahoma	5,477	5,226	+ 4.8	712	13.0	20,182,745	18,973,152	+ 6.4	11.74
Pennsylvania	1,550	1,616	— 4.1	....	....	2,721,800	2,938,386	— 7.4	1.58
Tennessee	25	30	— 16.7	23	92.0	33,275	31,207	+ 6.6	0.02
Texas	17,822	16,757	+ 6.4	4,119	23.1	77,361,962	72,632,513	+ 6.5	45.00
Dist. 1—South Central	577	509	+ 13.4	216	37.4	1,750,041	1,551,002	+ 12.8	1.02
Dist. 2—Middle Gulf	751	689	+ 9.0	236	31.4	4,326,511	4,004,859	+ 8.0	2.52
Dist. 3—Upper Gulf	1,612	1,591	+ 1.3	348	21.6	9,934,756	9,552,040	+ 4.0	5.78
Dist. 4—Lower Gulf-S.W.	1,698	1,660	+ 2.3	387	22.8	7,473,020	8,103,934	+ 4.6	4.93
Dist. 5—East Central	462	206	+ 124.3	178	38.5	1,776,390	919,165	+ 93.3	1.03
Dist. 6—Northeast	764	715	+ 6.9	78	10.2	3,771,104	3,436,503	+ 9.7	2.19
Dist. 7-B—North Central	2,982	2,085	+ 43.0	1,220	40.9	8,376,438	5,752,302	+ 45.6	4.87
Dist. 7-C—West Central	1,546	925	+ 67.1	372	24.1	6,816,314	3,887,076	+ 75.4	3.96
Dist. 8—West	3,784	4,129	— 8.4	412	10.9	21,027,688	23,007,476	— 8.6	12.23
Dist. 9—North	2,842	3,190	— 10.9	648	22.8	8,571,472	9,096,332	— 5.8	4.99
Dist. 10—Panhandle	804	1,058	— 24.0	24	3.0	2,538,228	3,321,824	— 23.6	1.48
Utah	35	24	+ 45.8	28	80.0	131,040	83,875	+ 56.2	0.08
West Virginia	574	607	— 5.4	5	0.9	1,694,448	1,604,643	+ 5.6	0.99
Wyoming	782	594	+ 31.6	123	15.7	3,888,886	2,940,578	+ 32.2	2.26
Others[2]	18	53	— 66.0	11	61.1	62,578	134,744	— 53.6	0.04
Total United States	44,965	43,204	+ 4.1	9,139	20.3	171,902,650	159,405,641	+ 7.8	100.0

[1] Footage drilled in 1950 and footage forecast for 1951 drilling include that for all new wells seeking production and for input or disposal purposes, but do not include footage of old wells drilled deeper in 1950, nor that footage expected to be added by drilling old wells deeper in 1951.

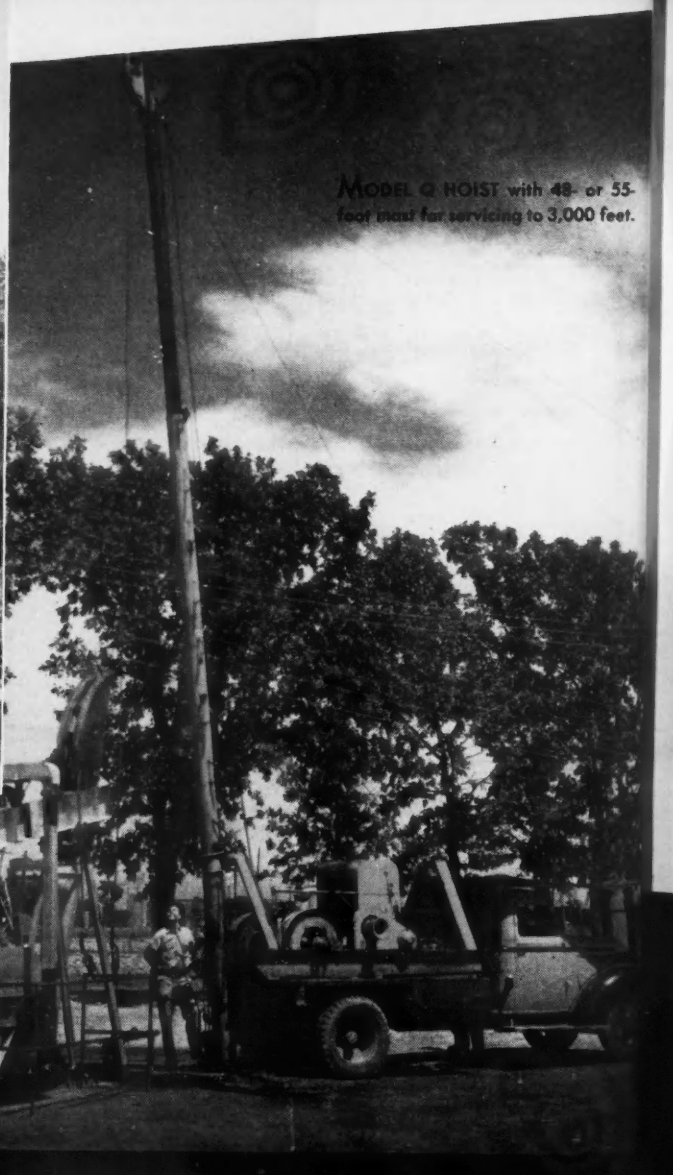
[2] Other states include: Arizona, Georgia, Idaho, Missouri, Nevada, North Carolina, South Dakota, Virginia and Washington.





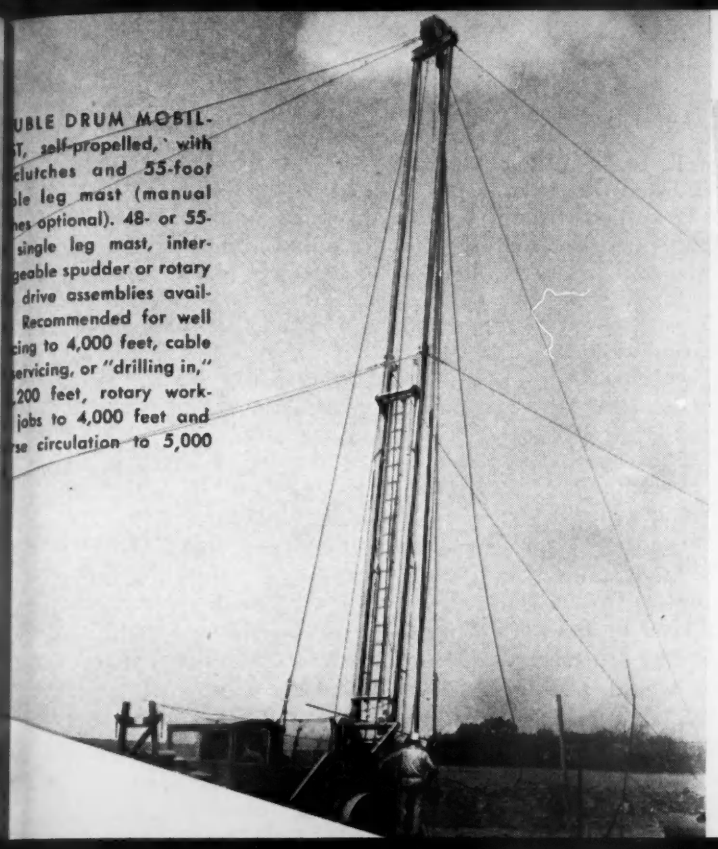
MODEL H or K single drum hoist with 48- or 55-foot single leg mast for servicing to 6,500 feet. Double leg mast is available.

Dollars go fast when wells



MODEL Q HOIST with 48- or 55-foot mast for servicing to 3,000 feet.

DOUBLE DRUM HOIST with spudder assembly and 65-foot mast. Models H, K and R are available with interchangeable cable tool and rotary table drive assemblies for cable tool or rotary workover from 2,500 to 10,000 feet, and well completion ("drilling in") from 1,500 to 7,500 feet.



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T, self-propelled, with
clutches and 55-foot
le leg mast (manual
es optional). 48- or 55-
single leg mast, inter-
geable spudder or rotary
drive assemblies avail-
Recommended for well
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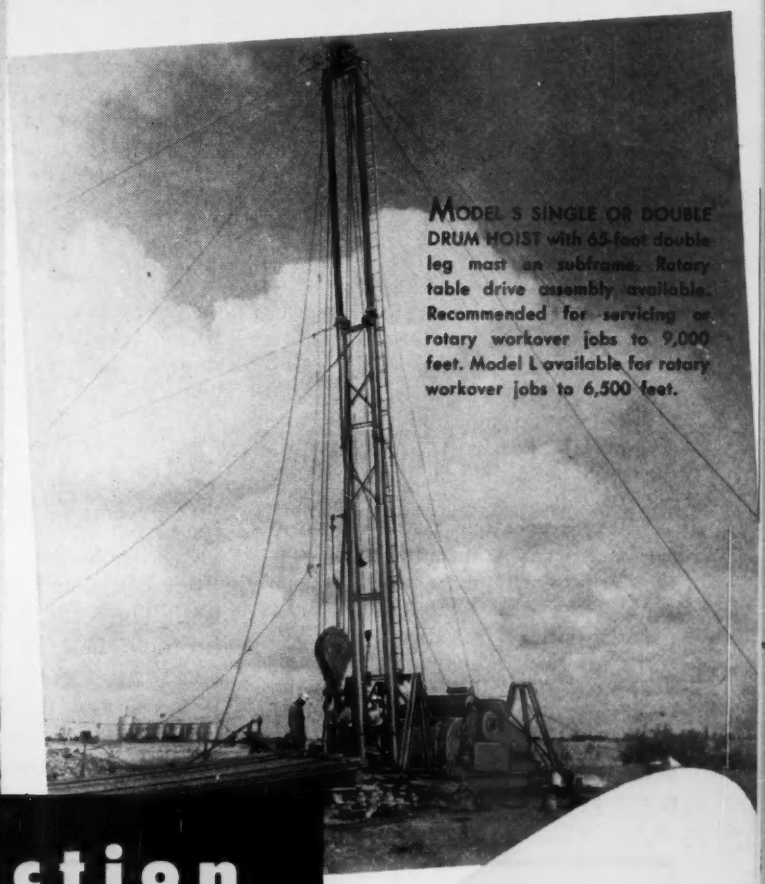

MODEL S SINGLE OR DOUBLE DRUM HOIST with 65-foot double leg mast on subframe. Rotary table drive assembly available. Recommended for servicing or rotary workover jobs to 9,000 feet. Model L available for rotary workover jobs to 6,500 feet.

s are off production

YOU are fully aware of the high cost of lost production, and you can eliminate much of these losses by selecting the proper servicing rig. One of the principal causes of lost production is poorly built servicing hoists or workover rigs. THE QUALITY OF SERVICING AND WORKOVER RIGS CAN NOT BE OVER-EMPHASIZED.

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As a result of 24 years of continuous research and careful study of field requirements, "Cardwell" rigs are available with attachments for every type of field procedure . . . "drilling in" with cable tools, well deepening with rotary or cable tools, squeeze jobs, reverse circulation and drilling from grass roots with cable tools or rotary.

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vailed in each of the postwar years, starting with a low of 15.2 percent in 1946.

At the beginning of the year 170,556,000 feet of hole was forecast, but this revision points to a substantial gain up to 171,902,650 feet. That would be 7.8 percent more than the 159,405,641 drilled in 1950, which was the greatest amount of footage drilled during a single year in the history of the industry.

The above estimated well and footage figures do not include old wells that will be deepened, or the footage that will be drilled in the deepening process.

This forecast was based on an extensive survey conducted by WORLD OIL among the companies that account for the majority of the industry's drilling. A number of the concerns queried indicated intentions of drilling considerably more wells than they had estimated at the start of the year; others saw fit to cut their budgets, and a few let their original estimates stand. There was, however, a definite swing to greater emphasis on wildcatting.

The number of wells to be drilled in each state or area listed consist of all types of wells to be drilled within proven areas, including those seeking new pays or outposts, and all strict wildcats and wells for the servicing of a lease or area, such as water-disposal and repressuring wells. Water wells, as such, or wells drilled in underground gas storage areas are not considered in this forecast.

Texas 45 Percent

Texas, estimated to drill 17,822 new wells during 1951, will account for 45 percent of the U. S. total. This year's wells are forecast to exceed those completed in 1950 by 6.4 percent. The 77,361,962 feet represented in those new wells would top the 72,632,513 feet drilled last year by 6.5 percent, and that would be a new high mark for the state. Oklahoma, scheduled to drill 5477 wells, is expected to better the 1950 mark by 4.8 percent and would increase the footage mark 6.4 percent with 20,182,745 feet.

Kansas with 4403 wells to be drilled follows for third rank among states. Such a program would represent a gain of 10.1 percent in the number of wells drilled and 14,970,200 feet would be a hike of 16 percent over 1950.

Texas' District 8 (West Texas) ranks fourth in the list of states and districts in the number of wells and footage to be drilled. Within that area, 3784 wells are scheduled and 21,027,688 feet drilled.

Two other Texas districts must be considered on the basis of total operations before the fourth ranking state, Illinois, earns a place. District 7-B (North Central Texas) should record 2982 wells and a gain of 43 percent over last year's efforts, and District 9 (North Texas) indicates that 2842 wells will be drilled, and that would be a loss of 10.9 percent.

(See Table, Page 70)

U. S. Drilling Rigs in Use During 1950 and 1951, by States, by Months

Figures are for end of month, and include rigs drilling, rigging up, and temporarily shut down.

STATE or DISTRICT	1950 May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1951 Jan.	Feb.	Mar.	Apr.	May	June
Alabama	3	11	4	8	7	5	8	8	6	6	9	3	3	3
Arizona	4	5	5	4	5	4	3	3	3	3	.....	.....	2	.....
Arkansas	24	34	26	29	26	36	37	30	27	30	25	24	31	29
California	223	259	210	209	208	232	192	207	206	227	220	229	247	201
Colorado	12	17	17	15	21	18	25	25	18	17	26	24	27	31
Florida	1	.....	2	2	1	1	1	1	1	1	.....	.....	1	2
Georgia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Idaho	3	3	3	3	2	1	1	1	1	.....	.....	.....	.....	.....
Illinois	249	266	274	263	255	255	250	246	189	155	172	195	222	207
Indiana	191	190	210	204	198	190	194	217	190	202	190	167	170	174
Kansas	351	350	362	348	322	330	333	337	340	341	366	433	409	427
Kentucky	108	113	116	112	106	108	110	104	92	89	84	93	107	93
Louisiana	217	243	234	242	227	229	252	235	217	204	196	223	210	223
North Louisiana	71	74	75	70	67	76	88	78	64	75	62	75	72	77
South Louisiana	146	169	159	172	160	153	164	157	153	129	134	148	138	146
Maryland	2	2	2	2	2	.....	5	8	6	10	14	16	21	24
Michigan	140	154	145	147	142	138	116	120	110	108	95	120	111	111
Mississippi	24	23	26	25	28	28	27	27	26	31	26	36	31	43
Missouri	7	6	6	7	8	6	6	6	5	5	5	5	6	6
Montana	29	32	42	39	41	41	37	34	29	22	26	41	43	58
Nebraska	3	9	12	12	11	13	10	9	11	11	13	12	10	9
Nevada	1	1	1	2	2	1	.....	1	2	2	1	2	2	2
New Mexico	75	103	98	95	87	87	87	108	113	125	129	118	114	121
New York	83	94	99	114	112	100	92	75	72	75	71	70	57	61
North Dakota	.....	1	2	4	1	2	2	2	1	2	2	2	2	4
Ohio	131	149	148	157	156	161	156	140	126	128	123	119	156	162
Oklahoma	527	593	619	644	671	692	671	682	563	545	575	590	604	614
Oregon	1	1	1	1	1	1	1	1	.....	.....	.....	.....	.....	.....
Pennsylvania	251	260	263	263	253	255	250	243	205	217	219	214	241	239
South Dakota	2	1	1	1	1	1	.....	.....	.....	.....	.....	.....	.....	.....
Tennessee	9	9	9	8	8	8	7	8	7	6	6	6	5	5
Texas	1,502	1,492	1,425	1,487	1,369	1,481	1,469	1,485	1,403	1,482	1,534	1,544	1,679	1,567
Dist. 1 South Central	30	32	28	39	30	38	34	35	38	43	43	38	40	36
Dist. 2 Middle Gulf	61	62	57	54	55	61	50	57	45	56	56	55	59	60
Dist. 3 Upper Gulf	137	144	129	130	126	150	144	149	138	128	141	135	142	142
Dist. 4 Lower Gulf-S.W.	130	117	101	131	121	118	104	110	113	120	124	119	136	123
Dist. 5 East Central	23	25	21	16	18	19	22	29	38	34	35	26	34	29
Dist. 6 Northeast	33	32	39	32	33	44	37	50	43	33	34	34	39	45
Dist. 7-B North Central	132	133	126	116	104	135	147	144	168	175	185	173	197	192
Dist. 7-C West Central	85	93	89	96	86	82	105	109	133	131	145	146	176	148
Dist. 8 West	532	526	514	563	509	547	484	459	439	432	463	498	502	441
Dist. 9 North	224	224	220	211	196	196	239	236	158	237	225	234	257	250
Dist. 10 Panhandle	115	104	101	99	91	91	103	107	90	93	83	86	97	101
Utah	7	8	9	8	8	12	10	11	12	11	14	12	18	22
Virginia	1	1	1	1	1	1	1	1	1	1	2	1	1	1
Washington	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
West Virginia	284	255	260	265	260	245	210	205	210	205	200	195	202	204
Wyoming	53	75	80	83	93	91	86	85	83	78	92	106	99	118
Total United States	4,518	4,760	4,712	4,804	4,633	4,773	4,649	4,665	4,275	4,339	4,435	4,600	4,831	4,762

The well on the left is an example of where two additional strings of protective casing were necessary — one to protect a zone of rock salt and the other to protect a sloughing shale. My-Lo-Jel Mud eliminated the necessity for this extra casing.

MY-LO-JEL

THE IMPROVED DRILLING MUD STARCH

can take the place of protective strings

Quick acting, tough, economical My-Lo-Jel provides positive control of filtration properties.

Magcobar My-Lo-Jel is an improved pregelatinized drilling mud starch in the form of a free flowing powder which can be added directly to the mud through a hopper mixer. My-Lo-Jel provides positive control of the filtration properties of mud even in the presence of salt, anhydrite and other contaminants. It is a blended starch that is especially processed to produce a quick acting, tough and chemically stable plugging agent to inhibit filtration of mud. Thus, it not only lowers water loss, but keeps it low.

My-Lo-Jel is economical and easy to use. So why take chances with tight holes due to filter cake when low water loss muds made with My-Lo-Jel can hold down the cost of drilling by eliminating strings of protective casing, preventing delays due to reaming, hole trouble and fishing jobs.

Look for the Magcobar sign when you need mud!

Look for this sign **WHEN YOU NEED MUD**

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DRILLING MUD SERVICE

DEALER

Footage and Average Depths Drilled in All Wells in the United States First Half of 1951

STATE or DISTRICT	OIL			DISTILLATE			GAS			DRY			WATER INPUT			GAS INPUT		
	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth
Alabama	15	66,537	4436							15	79,580	5305						
Arizona										2	3,820	1910						
Arkansas	103	307,939	2990	1	7,401	7401	2	7,781	3891	75	311,719	4156						
California	796	3,186,983	4004				15	68,234	4549	328	1,230,351	3751	2	8,130	4065			
Colorado	44	225,688	5129				4	16,912	4228	58	275,335	4747						
Idaho										1	12,844	12,844						
Illinois	418	1,068,638	2557				2	2,927	1464	621	1,599,611	2576						
Indiana	179	326,626	1825				8	8,534	1067	336	610,622	1817						
Kansas	919	3,118,202	3393	1	6,126	6126	179	492,774	2753	816	2,887,906	3539	1	2,854	2854			
Kentucky	210	383,434	1826				115	248,907	2164	254	532,983	2098	2	2,002	1001			
Louisiana	485	2,984,405	6153	60	594,405	9907	66	376,327	5702	387	2,521,039	6514	1	11,325	11,325			
North Louisiana	253	784,973	3103	20	163,358	8168	49	202,249	4128	201	853,193	4245						
South Louisiana	232	2,199,432	9840	40	431,047	10776	17	174,078	10,240	186	1,667,846	8967	1	11,325	11,325			
Maryland							14	52,936	3781	1	5,531	5531						
Michigan	109	312,880	2870				13	29,121	2240	220	528,083	2400						
Mississippi	51	313,584	6149	10	80,786	8079	5	41,798	8360	84	589,966	7023						
Missouri							2	411	206	1	247	247						
Montana	67	134,922	2014				4	10,587	2647	34	86,410	2541						
Nebraska	25	120,689	4828	1	4,695	4695	6	23,259	3877	39	177,624	4554						
Nevada										2	15,431	7716						
New Mexico	157	874,822	5572				85	307,440	3617	82	371,313	4528						
New York	149	209,653	1407										106	152,766	1441			
North Dakota										1	5,609	5609						
Ohio	147	282,536	1922				105	238,780	2274	146	292,907	2006				2	2,974	1487
Oklahoma	1,486	6,040,074	4065	7	60,150	8593	120	368,553	3071	964	3,152,959	3271	72	158,504	2201	3	4,529	1510
Pennsylvania	271	434,413	1603				96	238,315	2482	33	74,036	2244	262	419,986	1603	27	43,281	1603
Texas	5,025	22,520,842	4482	99	834,679	8431	412	1,890,522	4589	3,093	12,355,204	3995	21	41,742	1988	5	21,460	4292
Dist. 1 South Central	144	410,605	2851	1	7,450	7450	8	39,445	4931	135	416,048	3082						
Dist. 2 Middle Gulf	139	792,400	5701	17	137,103	8065	64	347,355	5427	152	863,427	5680				1	8,500	8500
Dist. 3 Upper Gulf	430	2,397,566	5576	28	266,706	9525	52	334,130	6426	251	1,690,422	6735				1	7,267	7267
Dist. 4 Lower Gul -S. W.	443	2,144,558	4841	24	195,789	8158	61	336,573	5518	303	1,478,551	4880	3	6,025	2008			
Dist. 5 East Central	99	515,801	5210	3	26,734	8911	5	29,467	5893	124	316,084	2549						
Dist. 6 Northeast	280	1,257,809	4492	13	96,028	7387	21	144,468	6879	58	337,953	5827						
Dist. 7-B North Central	603	1,677,099	2781				22	56,910	2587	698	1,987,666	2848	2	441	221			
Dist. 7-C West Central	426	1,878,992	4411	10	89,099	8910	2	5,748	2874	227	957,988	4220						
Dist. 8 West	1,549	8,564,800	5529				4	31,159	7790	362	2,055,022	5677	3	7,703	2568			
Dist. 9 North	739	2,352,881	3184	3	15,770	5257	7	36,989	5713	722	2,042,920	2830	13	27,573	2121	3	5,693	1898
Dist. 10 Panhandle	173	528,331	3054				166	525,278	3164	61	209,123	3428						
Utah	1	5,270	5270							11	39,657	3605						
West Virginia	35	70,776	2022				192	613,606	3196	57	154,099	2703						
Wyoming	223	1,133,361	5082				11	46,504	4228	106	511,004	4821						
Total United States	10,915	44,122,274	4042	179	1,588,242	8873	1,456	5,084,228	3492	7,767	28,425,891	3660	467	797,309	1707	37	72,244	1953

STATE or DISTRICT	SALT WATER DISPOSAL			TOTAL NEW WELLS (Preceding Classes) First Half 1951			TOTAL NEW WELLS (Preceding Classes) First Half 1950			OLD WELLS DRILLED DEEPER First Half 1951			TOTAL ALL WELLS First Half 1951			TOTAL ALL WELLS First Half 1950		
	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth
Alabama				30	146,117	4871	18	69,056	3836	1	251	251	31	146,368	4772	19	69,531	3660
Arizona				2	3,820	1910							2	3,820	1910			
Arkansas				181	634,840	3507	185	609,850	3296				181	634,840	3507	186	609,858	3279
California	2	14,741	7371	1,143	4,508,439	3944	833	3,661,590	4396	67	38,589	576	1,210	4,547,028	3758	904	3,713,338	4108
Colorado				106	517,936	4886	16	64,350	4022	3	8,205	2735	109	526,141	4827	19	66,815	3517
Florida							9	59,087	6565	1	1,684	1684	1	1,684	1648	9	59,087	6565
Georgia							3	13,270	4423							3	13,270	4423
Idaho				1	12,844	12844							1	12,844	12844			
Illinois	1	2,321	2321	1,042	2,673,497	2566	1,173	2,464,941	2101				1,042	2,673,497	2566	1,174	2,464,981	2101
Indiana	1	1,844	1844	524	947,626	1808	720	1,239,581	1722	2	193	97	526	947,819	1802	720	1,239,581	1722
Iowa							3	8,540	2847							3	8,540	2847
Kansas	15	58,116	3874	1,931	6,565,978	3400	1,823	5,899,954	3236				1,931	6,565,978	3400	1,825	5,900,416	3236
Kentucky	1	427	427	582	1,167,753	2006	486	885,993	1823				582	1,167,753	2006	486	885,993	1823
Louisiana				999	6,487,501	6494	1,174	7,204,339	6137	6	8,754	1459	1,005	6,496,255	6464	1,180	7,212,514	6112
North Louisiana				523	2,003,773	3831	608	2,183,684	3592	3	5,250	1750	526	2,009,023	3819	610	2,184,766	3582
South Louisiana				476	4,483,728	9420	566	5,020,655	8870	3	3,504	1168	479	4,487,232	9368	570	5,027,748	8821
Maryland				15	58,467	3898	1	3,612	3612				15	58,467	3898	1	3,612	3612
Michigan				342	870,084	2544	382	899,040	2354				342	870,084	2544	383	900,539	2351
Mississippi				150	1,026,134	6841	180	1,312,864	7294	3	3,110	1037	153	1,029,244	6727	180	1,312,864	7294
Missouri				3	658	219	22	14,297	650				3	658	219	22	14,297	650
Montana				105	231,919	2209	105	283,126	2696	3	985	328	108	232,904	2157	105	283,126	2696
Nebraska				71	326,267	4595	36	149,903	4164				71	326,267	4595	37	150,020	4055
Nevada				2	15,431	7716							2	15,431	7716			
New Mexico				324	1,553,575	4795	286	1,300,015	4546	10	18,354	1835	334	1,571,929	4706	295	1,309,036	4437
New York				255	362,419	1768	341	479,517	1406				255	362,419	1768	341	479,517	1406
North Dakota										1	5,609	5609	1	5,609	5609			
Ohio				400	817,197	2043	451	974,014	2160	17	9,115	536	417	826,312	1982	460	978,936	2128
Oklahoma	9	19,944	2216	2,661	9,804,713	3685	2,540	8,889,932	3500	77	60,023	780	2,738	9,864,736	3603	2,596	8,927,969	3439
Pennsylvania				689	1,210,031	1756	750	1,372,689	1830	15	12,641	843	704	1,222,672	1737	763	1,383,407	1813
South Dakota							1	5,710	5710							1	5,710	5710
Tennessee							3	3,993	1331							3	3,993	1331
Texas				8,655	37,664,449	4352	7,990	34,260,089	4288	170	123,363	726	8,825	37,787,812	4282	8,104	34,355,646	4239
Dist. 1 South Central				288	873,548	3033	226	628,555	2781	17	2,407	142	305	875,955	2872	234	632,512	2703
Dist. 2 Middle Gulf				373	2,148,785	5761	311	1,816,988	5842	9	27,063	3007	382	2,175,848	5696	316	1,823,759	5771
Dist. 3 Upper Gulf				762	4,696,091	6163	763	4,422,459	5796	4	16,074	4019	766	4,712,165	6152	771	4,445,859	5766
Dist. 4 Lower Gulf-S.W.				834	4,161,496	4990	815	3,962,801	4862	12	17,794	1483	846	4,179,290	4940	830	3,977,169	4792
Dist. 5 East Central				231	888,086	3845	97	391,740	4039	5	3,423	685	236	891,209	3776	98	391,838	3998
Dist. 6 Northeast				372	1,836,258	4936	309	1,465,639	4743				372	1,836,258	4936	311	1,470,285	4728
Dist. 7-B North Central				1,325	3,722,116	2809	925	2,634,699	2848	15	13,327	888	1,340	3,735,843	2788	932	2,648,560	2842
Dist. 7-C West Central				665	2,931,827	4409	394	1,695,316	4303	24	8,829	368	689	2,940,656	7991	410	1,710,694	4172
Dist. 8 West				1,918	10,658,684	5557	1,985	10,997,353	5540	70	26,200	374	1,988	10,684,884	5375	2,027	11,016,589	5435
Dist. 9 North				1,487	4,484,826	3016	1,668	4,682,410	2807	14	8,146	582	1,501	4,492,972	2993	1,675	4,683,986	2796
Dist. 10 Panhandle				400	1,262,732	3157	497	1,563,395	3146				400	1,262,732	3157	497	1,563,395	3146
Utah				12	44,927	3744	9	28,407	3156				12	44,927	3744	9	28,407	3156
Washington							2	16,032	8016							2	16,032	8016
West Virginia				284	838,481	2952	288	720,325	2501	10	12,289	1229	294	850,770	2894	299	732,706	2451
Wyoming				340	1,690,869	4973	264	1,307,829	4954	4	1,683	421	344	1,692,552	4920	266	1,309,887	4924
Total United States	29	97,393	3358	20,850	80,187,581	3846	20,094	74,201,945	3693	389	299,239	769	21,239	80,486,820	3790	20,395	74,439,628	3650

Steel Shortage to Restrict Industry Operations

By ROBERT E. SPANN, WORLD OIL Staff

PETROLEUM industry operations will be limited by shortages of steel well into the foreseeable future. Best estimates are for continued tight metal supplies through mid-1952, possibly longer.

Present indications are that the immediate months ahead will be the most critical. Although well completions in this year's first six months somewhat exceeded those in the like period last year, the increase narrowed considerably in recent months. This trend is attributed principally to a growing steel scarcity. Heretofore, shortages have been alleviated to some extent by use of inventories, but operators say inventories now are largely used up and henceforth cannot offer much relief.

Shortages of the essential metal result from an unprecedented demand that continues to outstrip rapidly mounting total production. America's steelmaking capacity is the largest in the world. Last year's peak output of 96.8 million tons of ingots was 44 percent higher than prewar 1940, and was nearly equal to the combined production of all other nations. For the first time in history, domestic steelmaking furnaces in the first six months of this year operated at an average of more than 100 percent of theoretical capacity, producing a record 52,273,000 tons of ingots. This is equal to an annual rate of nearly 105 million tons. To meet the continued rising demand, the steel industry in 1951 is spending $1.2 billion—more than twice the 1950 outlay—for further expansion. The presently planned new facilities will increase annual ingot capacity to 118 million tons by the start of 1953.

Defense requirements for steel will continue to mount in the coming months. This will necessitate higher demand by defense-supporting industries, and despite full coverage by priorities, there will not be enough steel produced—plus imports, now larger than ever before—to fill increased demands. For instance the National Production Authority reports demand for structural steel in the fourth quarter is double the nation's capacity to produce it.

Under the government's Controlled Materials Plan, more and more of the nation's steel output will be reserved for priority users, but meanwhile the list of preferred customers is being extended beyond military and defense-supporting industries to include some consumer product manufacturers. Starting September 1, NPA has ordered 95 percent of ingot production be set aside for priority users, and a month later a full CMP program is scheduled to begin which will make "free market" steel non-existent.

Deliveries Lagging

Despite the reservation during the third quarter of the entire production of seamless oil country tubular goods for defense-rated orders, the Petroleum Administration for Defense's steel program for the oil industry already has bogged down in the scramble for steel. And though the agency has made a strong plea to the Defense Production Authority for an increased allocation of steel for the final three months of the year (Table I), chances are dim that PAD actually will receive much more steel in the last quarter than is being delivered in the current three-month period.

PAD's experience in steel deliveries in July and those scheduled for August and September is a good indication of what oil men may expect toward getting tubular goods. DPA in mid-May allocated 1,539,000 tons of steel (396,800 tons of oil country goods, 779,800 tons of line pipe and 363,200 tons of other steel) to be distributed by PAD for domestic oil and gas operations. This included 180,000 tons of steel to be distributed to oil field equipment manufacturers. The allocation represented about 67 percent of PAD's programmed steel requirements for its planned completion of a minimum of 43,400 domestic wells (160 million feet), and was the equivalent of about 73 percent of the steel actually used by the domestic industry in the average quarter of 1950. The allotted amount and actual deliveries of steel to PAD by producing mills, however, are not synonymous. PAD officials state it has not been possible to find steel mills, distributors or warehouses that would accept rated orders for steel for third quarter delivery for any more than approximately 85 percent of the allocation.

Further, Frank A. Watts, director of PAD's materials division, in a recent letter to DPA materials officials, noted that the supply of steel was also tangled by a lag in orders placed prior to this year. Purchase orders placed with and accepted by steel mills from 1946 to 1950, it was stated, for delivery during the third quarter of 1951 have been set back on mill schedules. Indications are that the slippage in deliveries from the third quarter to the final three months of

TABLE 1

Petroleum Industry Steel Picture for Final Six Months of 1951

OPERATION	OIL COUNTRY TUBULAR GOODS (Tons)		LINE PIPE (Tons)		OTHER CARBON and ALLOY STEEL (Tons)		TOTAL (Tons)	
	4th Quarter Requests of PAD	3rd Quarter Actual PAD Allotment	4th Quarter Requests of PAD	3rd Quarter Actual PAD Allotment	4th Quarter Requests of PAD	3rd Quarter Actual PAD Allotment	4th Quarter Requests of PAD	3rd Quarter Actual PAD Allotment
Domestic Industry	437,000	396,800	1,132,940	779,800	566,464	363,200	2,136,404	1,539,800
Export to Canada	15,000	13,200	17,501	20,900	20,629	21,400	53,130	55,500
Other Foreign	38,000	40,000	50,033	58,190	58,903	115,420	146,936	213,610
Total	490,000	450,000	1,200,474	858,890	645,996	500,020	2,336,470	1,808,910

this year may amount to as much as 150,000 tons, which would be enough tubular goods for 13.6 million feet of drilling in PAD's method of programming steel requirements.

PAD earlier this year set its sights on 1951 steel industry shipments of 1,890,000 tons of oil country tubular goods, which would be an increase of 11 percent over actual 1950 shipments. This was broken down to consist of 1,762,000 tons for the domestic industry and 128,000 tons for use in foreign areas supplying the U.S. To meet PAD's 1951 program, shipments of oil country tubular goods would have to average 157,500 tons a month, and though total shipments in the first five months of this year at 776,432 tons are nearly 16 percent greater than in the like 1950 period, the monthly average amounts to only 155,286 tons. Deliveries, however, have increased from an average of 130,000 tons a month in the first quarter to 164,935 tons during May. Whether this latter rate of shipments can be maintained with a rising total demand for steel is uncertain. Viewing the increased shipments and the poor results in obtaining oil country goods in the current quarter, PAD upped its request for fourth quarter allocation to 490,000 tons (437,000 tons for domestic use) from the allocation of 450,000 tons of oil country tubular goods for the third quarter.

The line pipe situation is more critical. In its request to DPA, PAD stated that actual domestic oil and gas needs for steel in the quarter beginning October 1 are about 250,000 tons greater than the total of 2,136,404 tons programmed. PAD said the full requirements were not requested since there is no indication that production of line pipe can be increased during the fourth quarter to either the 1950 rate of production or the required rate. Total line pipe requested for fourth quarter delivery is 1,200,474 tons, of which 1,132,940 tons would be for domestic operations. The latter includes 110,000 tons of line pipe for the producting branch, or nearly double the allocation of 56,000 tons for the third quarter, and 609,500 tons for gas transmission and distribution facilities. The latter, PAD stated, represents the absolute minimum tonnage required to complete gas line projects to critical areas. The actual requirements of the gas branch to complete all existing construction were placed at in excess of one million tons. The gas transmission division was allotted 517,000 tons of pipe line pipe for third quarter use, which PAD claims amounts to only 51 percent of minimum requirements.

Slippage in line pipe shipments in the first six months of the year plus failure to obtain the entire third quarter allocation from mills accounts for the large needs for the last three months of 1951 and will also account for a sizeable tonnage figure for the first quarter of 1952, according to PAD. Actual mill deliveries are lagging behind 1950, however. Total line pipe shipments by the industry in the first five months of the year were 1,233,677 tons, down 14.5 percent from the 1,443,696 tons in the like 1950 period.

Aside from the general tightness in steel supplies, the intense competition from military and other essential users for steel plate, required to make large diameter line pipe, is a big factor in the acute pipe supply. Plate is the primary steel product in making such needed equipment as tanks, armor, freight cars, tank cars and ships. Of PAD's total fourth quarter requests for line pipe, more than half, 650,000 tons, consist of 16-inch diameter pipe and larger.

While the oil industry in fulfilling the higher level of activity in the first half of the year has been able to draw on inventories, conversion and imported steel for urgent requirements, two of these sources are being eliminated in the future schemes of the government planners. Starting with the third quarter, inventories have been considered in PAD's distribution of steel, and under the full CMP program planned for the fourth quarter, conversion steel will no longer be available.

Conversion steel, while chargeable against PAD distribution to operators, theoretically provides increased production of finished steel products. In practice, for example, one pipe mill may be able to finish an order except for final threading. A second mill with available threading capacity could complete this pipe for industry use. A more striking example of the value of conversion methods of production was recently pointed up by PAD. In urging the need for procedures to assure increased production of line pipe, PAD noted that steel has recently been diverted from the large diameter pipe rolling mills for other purposes. These mills, it was stated, have total capacity for producing about 900,000 tons of pipe a quarter and some are operating at about 50 percent capacity. While it has added some extra capacity, the conversion method results in final costs of finished steel products from 25 percent to 50 percent above normal price quotations.

An important source of extra steel, not chargeable against distributed supplies from PAD, has been imports, though delivered prices range from 50 to 100 percent above U. S. domestic quotations. The significant part of imported steel to the oil industry in 1951 is shown in Commerce Department figures in Table 2. PAD officials report actual imports of steel for the oil industry have been much higher than these official figures indicate. Information made available to PAD is that oil country tubular goods during the first six months have been imported at a rate averaging between 10,000 and 12,000 tons a month and that line pipe imports have averaged between 20,000 and 25,000 tons a month.

TABLE 2

U. S. Imports of Pipe and Tubes

(Tons)

SOURCE	Total 1949	Total 1950	1951 January	1951 February	1951 March	1951 April
Pipe and Tubes Not Less Than ⅜- Inch Diameter:						
Canada	25	158	1,089	1,616	108	27
United Kingdom	1,017	2,095	675	843	583	1,284
Netherlands	.....	9	.....	.....	.....	6
Belgium and Luxembourg	.....	787	741	358	463	615
France	.....	1,366	595	758	1,092	364
Germany	.....	8,071	3,688	801	2,169	1,107
Japan	158	.....	16	.....	.....	.....
Other	.....	.....	.....	.....	369	16
Total	1,200	12,486	6,804	4,376	4,784	3,419
Pipe and Tubes of Iron or Steel Not Specified:						
Canada	2	115	.....	56	46	49
United Kingdom	46	16	7,267	1,579	9,136	7,442
Belgium and Luxembourg	.....	385	1,095	1,844	1,840	412
France	.....	815	3,380	2,758	3,462	4,984
Germany	3,030	14,936	7,790	5,704	4,771	5,310
Italy	4	321	.....	4,166	.....	5,006
Sweden	.....	11,108	.....	.....	.....	.....
Czechoslovakia	.....	193	.....	.....	.....	.....
Japan	1,158	.....	.....	79	463	.....
Total	4,240	27,889	19,532	16,186	19,718	23,622
GRAND TOTAL	5,440	40,375	26,336	20,562	24,502	26,622

Source: U. S. Department of Commerce.

$32.9 BILLION Investment Makes Oil Fourth Largest U. S. Industry

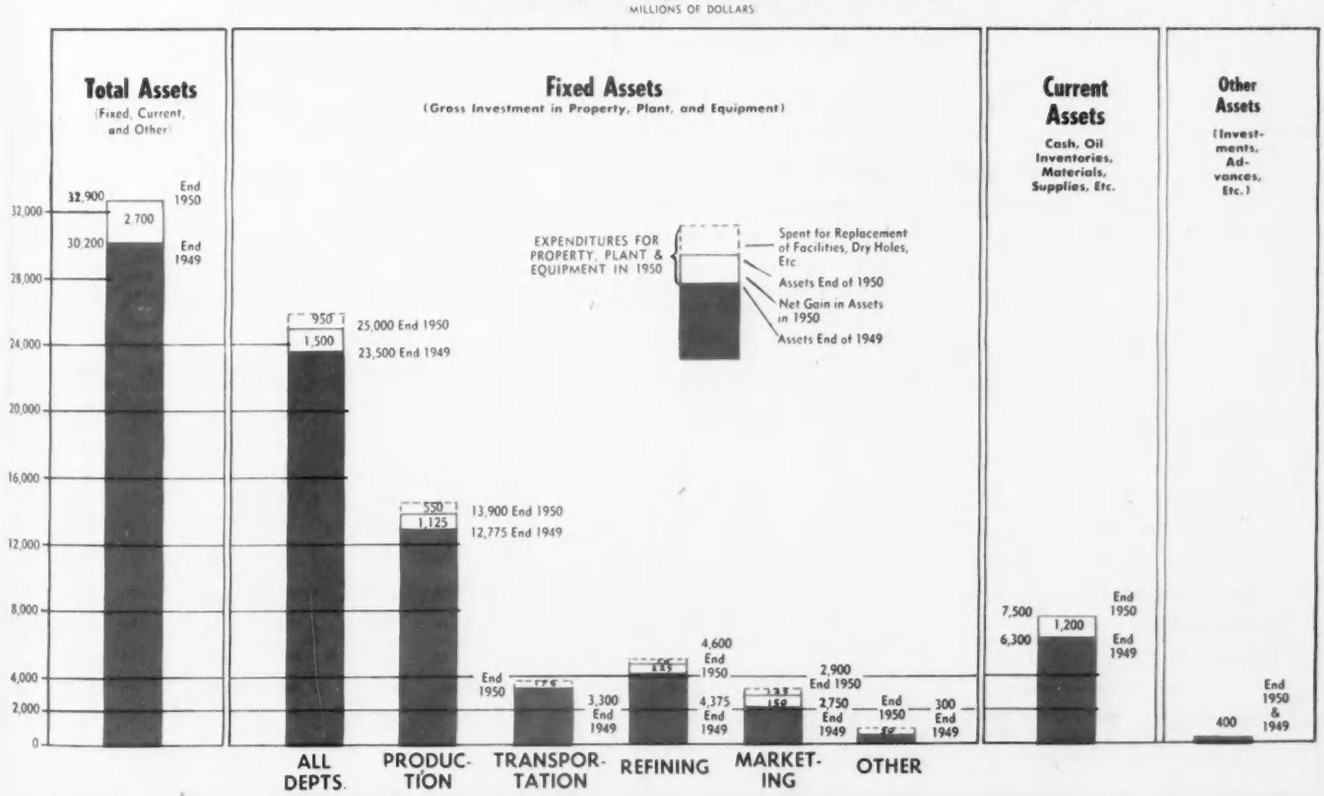
THE U. S. petroleum industry has expended $12.3 billion in capital additions in the five postwar years, increasing crude production and refining facilities by about one-third and boosting gross assets employed to $32.9 billion at the end of 1950. Estimated total expenditures in 1950 of $2450 million for property, plant and equipment, while a little below that of each of the three preceding years, were larger than in any other year up through 1946.

This appraisal of the nation's fourth largest industry, exceeded in terms of capital investment only by agriculture, railroads and combined divisions of the public utility field, was contained in the annual study of Frederick G. Coqueron and Joseph E. Pogue, of the Petroleum department of the Chase National Bank of the City of New York, entitled, "Financial Analysis of Thirty Oil Companies for 1950."

As a result of the substantial capital expenditures of about $12.3 billion since World War II, "the U. S. petroleum industry is well prepared to meet the requirements of the defense preparations in which this country is now engaged," the authors stated. The total outlay in the five-year period was distributed 61.4 percent for crude oil production facilities, 15.8 percent for refining, 10.2 percent for transportation, 10.1 percent for marketing, and 2.5 percent for other facilities.

Utilizing about $33 billion of total gross assets, the petroleum industry of the U. S. is one of the largest and most important segments of the country's economy, according to the authors. It gives direct employment to more than 1.8 million workers, constitutes a large purchaser of a wide range of materials from other industries, and serves practically the entire economy with essential com-

Assets Employed (or Investment) in U. S. Petroleum Industry at End of 1949 and 1950 and Capital Expenditures Made in 1950



modities. "Consequently, the well-being of the oil industry is of prime importance to the whole country."

In terms of capital investment, stated Coqueron and Pogue, the petroleum industry is considered the fourth largest in the country. It is exceeded in size only by agriculture, the railroads, and the combined divisions of the public utility field.

Total gross assets employed by the entire petroleum industry in the U. S. was estimated in the report to have amounted to $32,900 million at the end of 1950. The main components of this figure are: (1) $7500 million in current assets, including cash, oil inventories, materials, and supplies; (2) $25,000 million in fixed assets or property, plant, and equipment; and $400 million in the form of investments, advances, and other assets.

The $25,000 million of gross fixed assets, which represents the industry's investment in property, plant, and equipment, is distributed by departments as follows: 55.6 percent in production installations and properties, 13.2 percent in transportation systems, 18.4 percent in refining, 11.6 percent in marketing, and 1.2 percent in other facilities.

Despite the substantial expenditures necessary for the petroleum industry to keep up with the expanding economic activity and the unprecedented level of sales in 1950, the authors noted that one source of capital funds for expansion—earnings—was less than reported for the peak profit year 1948 because of increased costs and taxes. While stating that the record U. S. demand for crude and refined products in 1950 exceeded new supply by an average of 56,000 barrels a day, the report called attention to the continued steady domestic crude prices, which have not kept pace with the spiral of inflation "in spite of higher taxes, wages and material costs."

Estimated Assets Employed (Or Investment) in U. S. Petroleum Industry, December 31, 1950

(Source: Chase National Bank bulletin, "Financial Analysis of 30 Oil Companies for 1950")

ITEM	NET ASSETS		GROSS ASSETS	
	$ Million	Percent of Total	$ Million	Percent of Total
Current Assets	7,500	36.4	7,500	22.8
Investments and Advances	150	0.7	150	0.5
Property, Plant and Equipment	12,700	61.7	25,000	76.0
Other Assets	250	1.2	250	0.7
Total	20,600	100.0	32,900	100.0

The detailed study of the financial results of 30 major oil companies, comprising about two-thirds of the domestic industry, showed that the combined net income of the group increased 23.6 percent over 1949 to $1739 million, on a rise of 12.1 percent in gross revenues to $15,574 million, while total operating costs and other deductions advanced 8.3 percent to $13,007 million and taxes charged to income bounded up 46.1 percent in 1950 to $1150 million. The latter figure is exclusive of consumer taxes of gasoline and other petroleum products in the amount of $1914 million collected by the companies for government agencies.

Preferred and common cash dividends declared by the group for payment to stockholders totaled $686 million in 1950, which was 39.4 percent of available earnings and was the largest disbursement in the 17-year period, 1934-1950, for which the bank has detailed pertinent data of the 30 companies. The balance of $1053 million of earnings was reinvested in the business or retained.

In 1950, the group obtained funds totaling only $159 million from banks, insurance companies and public investors, compared with a peak of $682 million in 1947 and $641 million in 1949. Of the total raised, $152 million represented borrowings and $7 million sale of common stock. Of the proceeds, 56.6 percent was applied to retirement of existing obligations and 43.4 percent went for acquisition of new assets and working capital. The total cash flow of the 30 companies was $3444 million, of which 89.4 percent was provided by earnings, 4.6 percent derived from the issuance of long-term debt and stock, and 6 percent generated from the sale of assets and other transactions. Of the total disposed, amounting to $3030 million, 65 percent went for capital expenditures and related business investments, 23.9 percent for dividends to stockholders and minority interest, and 11.1 percent for refunding and retirement of long-

• CONTINUED ON PAGE 76

Property, Plant, and Equipment of U. S. Petroleum Industry

(Source: Chase National Bank Bulletin, "Financial Analysis of 30 Oil Companies for 1950.")

DEPARTMENT	ESTIMATED EXPENDITURES FOR PROPERTY, PLANT, AND EQUIPMENT IN YEARS 1946-1950 — Million Dollars					5 Yrs., 1946-1950		ESTIMATED INVESTMENT DECEMBER 31, 1950, IN PROPERTY, PLANT AND EQUIPMENT — Gross		Net	
	1946	1947	1948	1949	1950	$ Million	Percent of Total	$ Million	Percent of Total	$ Million	Percent of Total
Production Department	**1,100**	**1,425**	**1,700**	**1,650**	**1,675**	**7,550**	**61.4**	**13,900**	**55.6**	**6,725**	**52.9**
*Oil Leases, Wells, Equipment	1,050	1,325	1,550	1,450	1,500	6,875	55.9	12,800	51.2	6,050	47.6
Natural Gasoline Plants	35	50	100	110	75	370	3.0	750	3.0	450	3.5
*†Natural Gas	15	50	50	90	100	305	2.5	350	1.4	225	1.8
Transportation Department	**170**	**310**	**325**	**270**	**175**	**1,250**	**10.2**	**3,300**	**13.2**	**1,750**	**13.8**
Crude Oil Pipe Lines	75	130	180	150	125	660	5.4	1,525	6.1	775	6.1
Product Pipe Lines	30	40	30	25	25	150	1.2	325	1.3	200	1.6
Marine	60	125	100	75	15	375	3.0	1,100	4.4	650	5.1
Tank Cars; Motor Trucks	5	15	15	20	10	65	0.5	350	1.4	125	1.0
Refining Department	**250**	**400**	**600**	**420**	**275**	**1,945**	**15.8**	**4,600**	**18.4**	**2,300**	**18.1**
Marketing Department	**200**	**300**	**225**	**240**	**275**	**1,240**	**10.1**	**2,900**	**11.6**	**1,750**	**13.8**
Others	**30**	**65**	**100**	**70**	**50**	**315**	**2.5**	**300**	**1.2**	**175**	**1.4**
Total, All Departments	**1,750**	**2,500**	**2,950**	**2,650**	**2,450**	**12,300**	**100.0**	**25,000**	**100.0**	**12,700**	**100.0**

* Expenditures include costs of drilling dry holes.

† Expenditures include those for transportation facilities.

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MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Junior Directors Help In Company Management

C. J. ALLEN

TOP management officials of any large enterprise constantly are required to make decisions on major policy proposals as well as those of lesser importance concerning daily operating problems. Regardless of their scope, conclusions normally are reached only after complete and time-consuming study.

The operational complexities of a major petroleum company are such that it has become increasingly difficult for a small group of chief executives to perform a thorough job of policy making. As an aid to management in its studies to reach decisions, Sinclair Oil Corporation has created an innovation in the oil industry with the establishment of a junior board of directors responsible to the "senior" board, the governing representatives of stockholders.

This junior board, composed of key junior executives, has an authorized membership of 25 and presently consists of 21 members under the chairmanship of C. J. Allen, assistant to Sinclair's president and a vice president of Sinclair Refining Company. The board's membership represents every segment of the company's nationwide operations. In discussing the board's formation, President P. C. Spencer noted that "it should prove extremely beneficial in more ways than one if our junior executives are given an opportunity to participate before, rather than after, company policies are officially adopted." He listed the principal reasons for the group's creation as:

- To give junior executives an opportunity to participate more fully in the affairs of top management.
- To develop and use the proven ability of junior executives, by giving them a more complete understanding of company operations.
- To thereby discover among the group those who possess sufficient talent to be placed on the senior board of directors as and when the occasions for such placement may arise.

A rotating membership with the maximum term not to exceed one year is provided under the bylaws. Under this plan the board will draw continually as its members the most promising of the company's 20,000 employes. Regular and special meetings are held by the junior board under the same procedure and formality of its senior counterpart. The junior members are required to review, survey, and make recommendations respecting all phases of Sinclair's operations. Among those studied so far include such major policy proposals as the advisability of constructing additional inland water terminals, crude oil and refined products pipe line expansion, desirability of increasing marketing facilities, and the necessity for construction of additional deep water, lake and river transportation.

While most of the work of the junior board is to study and develop assigned proposals under consideration by the 12-member senior board, the junior board members are encouraged to initiate studies that may be developed and passed to the senior board. Generally, reports assigned by the senior board or initiated by junior board members are passed to a working committee of junior directors for first action. Upon completion, the committee's recommendations are presented to the full junior board for consideration, and if approved, are submitted to be placed on the agenda of the senior board. When the completed reports of the junior directors are brought up for senior board study, the chairman of the junior board makes a formal presentation, assisted as necessary by the junior board committee that prepared the report.

$32.9 Million Investment

■ CONTINUED FROM PAGE 74

term debt and preferred stock. The excess of funds provided over those disposed, amounting to $414 million, was added to working capital which, at the end of the year, totaled $3852 million.

Capital expenditures of the 30 companies in 1950 totaled $1,894 million, including $1,667 million for U. S. facilities and $227 million for foreign projects.

Of the total, 63 percent was expended for crude production, 14.8 percent for refining, 8 percent for transportation, 12.3 percent for marketing, and 1.9 percent for other facilities. In addition to the expenditures of $985 million made by the group for domestic crude production facilities, disbursements of $65 million for undeveloped lease rentals and $150 million for exploratory expenses were made and charged to earnings, making a total of $1200 million allocated for exploration and development of U. S. crude oil reserves. The outlay averaged $1.18 for each barrel produced in the U. S. by the 30 companies in 1950, compared with $1.21 a barrel in 1949.

The combined world-wide crude oil production of the group averaged 3,669,000 net barrels daily in 1950, an increase of 6.5 percent over 1949. The domestic operations of the 30 companies contributed 2,784,000 net barrels per day, which represented 51.5 percent of the total production of the U. S. The volume of crude oil processed by the domestic and foreign refineries of the group established a new record in 1950, averaging 5,729,000 barrels a day, an increase of 9.3 percent over 1949. The domestic facilities of the group ran to stills 4,943,000 barrels daily, or about 86.1 percent of the total throughput of all refineries operating in the U. S.

Completions

Rise 4.1 Percent Over 1950 Period

WELLS completed during the first half of 1951 reflected a rise of 844 over the number completed in the corresponding period of the previous year. Completions totaled 21,239, slightly more than 4.1 percent above the 20,395 wells completed in the same period in 1950. WORLD OIL's prediction for 1951 completions, based on estimates of major drilling concerns, had indicated a 4 percent rise over the all-time high of 1950.

Footage drilled in 1951 showed a greater increase than the percentage of completion increase. The cumulative 1951 footage drilled totaled 80,486,820, which was 6,047,192 feet or 8.1 percent more than 1950 footage of 74,439,628. Footage trend also followed WORLD OIL's prediction, which placed total feet drilled at an estimated 7 percent increase for the year.

That the trend currently is toward deeper tests is borne out by a comparison of average footage per well. In 1950 the average depth of each new well was 3693 feet, an all-time annual average depth record; however, during the first half of 1951 the record was being outpaced by an average depth of 3846, or 153 feet per well.

Texas' 8825 wells in the first six months of 1951 showed an 8.9 percent rise over the same period in 1950 and an increase in footage of 3,432,166 to 37,787,812—an average 1951 new well depth of 4352 feet, 506 feet more than the national average.

At the close of June, 4762 drilling rigs were in operation, 69 fewer than at the end of the previous month, but two more than at the same time in 1950.

Well Completions in the United States During June, and First Six Months, 1951

(Figures compiled by WORLD OIL Staff from private reports and other sources as follows: Illinois from Illinois Geological Survey; Indiana from Indiana Division of Geology; Missouri from Missouri Geological Survey; Tennessee from Tennessee Division of Geology; Bradford, Kane-Clarendon and Allegany fields of Pennsylvania and New York from the Producers Monthly.)

State or District	MONTHLY COMPLETIONS, JUNE, 1951 — NEW WELLS: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	TOTAL COMPLETIONS: June, 1951	May, 1951	June, 1950	Footage June, 1951	CUMULATIVE TOTALS January-June: Wells 1951	Wells 1950	Percent Diff.	Footage, 1951	Footage, 1950	Rigs in Operation (Drilling, Rigging-Up and Shut Down): June 30, 1951	May 31, 1951	June 30, 1950
Alabama	1			3				4		4	6	4	24,345	31	19	+ 63.2	146,368	69,531	3	3	11
Arizona														2			3,820			2	5
Arkansas	15			18				33		33	33	31	115,902	181	186	— 2.7	634,840	609,858	29	31	34
California	167		2	59	1			229	13	242	201	150	868,173	1,210	904	+ 33.8	4,547,028	3,713,338	201	247	259
Colorado	9		2	17				28	2	30	16	1	148,565	109	19	+473.7	526,141	66,815	31	27	17
Florida												2		1	9	— 88.9	1,684	59,087	2	1	
Georgia												1			3	—100.0		13,270			
Idaho														1	3	— 66.7	12,844	8,540			3
Illinois	94			187			1	282		282	222	274	807,096	1,042	1,174	— 11.3	2,673,497	2,464,981	207	222	266
Indiana	61		1	90				152	1	153	86	183	285,942	526	720	— 27.0	947,819	1,239,581	174	170	190
Kansas	177		37	134			4	352		352	403	337	1,230,603	1,931	1,825	+ 5.8	6,565,978	5,900,416	427	409	350
Kentucky	51		19	77				147		147	120	117	304,653	582	486	+ 19.8	1,167,753	885,993	93	107	113
Louisiana	89	9	14	72				184	2	186	164	211	1,140,820	1,005	1,180	— 14.8	6,496,255	7,212,514	223	210	243
North Louisiana	51	1	13	42				107	1	108	83	123	401,540	526	610	— 13.8	2,009,023	2,184,766	77	72	74
South Louisiana	38	8	1	30				77	1	78	81	88	739,280	479	570	— 16.0	4,487,232	5,027,748	146	138	169
Maryland			4	1				5		5	3		21,465	15	1	+1,400.0	58,467	3,612	24	21	2
Michigan	25		2	59				86		86	52	57	221,972	342	383	10.7	870,084	900,539	111	111	154
Mississippi	11	1		18				30	1	31	38	27	191,533	153	180	— 15.0	1,029,244	1,312,864	43	31	23
Missouri												2		3	22	— 86.4	658	14,297	6	6	6
Montana	14		4	7				25		25	31	22	50,014	108	105	+ 2.9	232,904	283,126	58	43	32
Nebraska	3	1	1	8				13		13	13	9	60,466	71	37	+ 91.9	326,267	150,020	9	10	9
Nevada											1			2			15,431		2	2	1
New Mexico	28		25	14				67	3	70	47	53	352,840	334	295	+ 13.2	1,571,929	1,309,036	121	114	103
New York	28				21			49		49	47	75	70,773	255	341	— 25.2	362,419	479,517	61	57	94
North Dakota														1			5,609		4	2	1
Ohio	33		28	25				86	3	89	67	98	165,808	417	460	— 9.4	826,312	978,936	162	156	149
Oklahoma	287	2	20	141	25	1	1	477	11	488	472	439	1,803,181	2,738	2,596	+ 5.5	9,864,736	8,927,969	614	604	593
Oregon																					1
Pennsylvania	62		11	4	64	4		145	5	150	131	155	247,314	704	763	— 7.7	1,222,672	1,383,407	239	241	260
South Dakota															1	—100.0		5,710			1
Tennessee															3	—100.0		3,993	5	5	9
Texas	929	18	* 72	610	6	1		1,636	31	1,667	1,413	1,413	7,217,821	8,825	8,104	+ 8.9	37,787,812	34,355,646	1,567	1,679	1,492
Dist. 1 S. Central	16		3	24				43		43	54	49	147,410	305	234	+ 30.3	875,955	632,512	36	40	32
Dist. 2 Middle Gulf	20	5	13	30				68	1	69	63	69	388,007	382	316	+ 20.9	2,175,848	1,823,759	60	59	62
Dist. 3 Upper Gulf	72	6	12	66				156	1	157	129	127	951,033	766	771	— 0.7	4,712,165	4,445,859	142	142	144
Dist. 4 L. Gulf-S.W.	91	5	20	73				189	7	196	128	162	908,874	846	830	+ 1.9	4,179,290	3,977,169	123	136	117
Dist. 5 E. Central	23		1	21				45	1	46	38	23	194,194	236	98	+140.8	891,509	391,838	29	34	25
Dist. 6 Northeast	51	2	3	11				67		67	66	45	318,332	372	311	+ 19.6	1,836,258	1,470,285	45	39	32
Dist. 7-B N. Central	137		1	140				278	2	280	228	169	796,967	1,340	935	+ 43.3	3,735,543	2,648,560	192	197	133
Dist. 7-C W.Central	77			42				119	4	123	111	78	546,182	689	410	+ 68.0	2,940,656	1,701,694	148	176	93
Dist. 8 West	294		1	65	1			361	13	374	301	353	2,005,339	1,988	2,027	— 1.9	10,684,884	11,016,589	441	502	526
Dist. 9 North	112		2	132	5	1		252	2	254	251	247	790,588	1,501	1,675	— 10.4	4,492,972	4,683,986	250	257	224
Dist. 10 Panhandle	36		16	6				58		58	44	91	170,895	400	497	— 19.5	1,262,732	1,563,395	101	97	104
Utah											4	1		12	9	+ 33.3	44,927	28,407	22	18	8
Virginia																			1	1	1
Washington															2	—100.0		16,032	1		
West Virginia	6		29	9				44		44	40	41	126,795	294	299	— 1.7	850,770	732,706	204	202	255
Wyoming	41		2	20				63	1	64	63	45	289,235	344	266	+ 29.3	1,692,552	1,309,887	118	99	75
Total U. S.	2,131	31	273	1,573	117	6	6	4,137	73	4,210	3,673	3,748	15,745,316	21,239	20,390	+ 4.1	80,486,820	74,439,628	4,762	4,831	4,760

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Giant Compressor

Clark Bros. Company, Inc., has published a new bulletin covering its HLA 17 x 19-inch gas engine driven compressor, which, it claims, delivers more horsepower per square foot of floor space than any other similar compressor.

Circle No. 1 on Postcard

Pressure Testing

A new bulletin describes the Hydro-Test, Inc., method of pressure-testing for pipe and tubing. The test finds leaks in tubing while the tubing is being pulled, while it is being run back into the well, or at the rack.

Circle No. 2 on Postcard

Oil Field Equipment

A new 71-page condensed catalog covers all Ideco equipment, complete with photos, descriptions and specifications for all Ideco drilling, servicing, and general oil field equipment.

Circle No. 3 on Postcard

Couplings and Sleeves

Style 38 couplings and Style 40 long sleeves for joining steel and cast iron pipe are described in a new 34-page catalog by Dresser Manufacturing Division. The book also covers the Dresser line of compression fittings and contains a spread illustrating the principal types of clamps, repair sleeves, expansion joints and other products made by the company.

Circle No. 4 on Postcard

Desulfurization

What the Black, Sivalls & Bryson Desulfurizer is and how it works are discussed in a new bulletin. The bulletin includes a middle spread with a foldover diagrammatic drawing of a complete desulfurizing hookup.

Circle No. 5 on Postcard

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BOX 2608
HOUSTON 1, TEXAS, U. S. A.

WORLD OIL Reader Service POSTCARD **August, 1951, Issue***

EDITORIAL ITEMS—Circle item numbers on which more information desired:

1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69	73	77
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70	74	78
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71	75	79
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80

ADVERTISEMENTS—Circle key number of each advertisement on which more product information is wanted.

A1	B1	C1	D1	E1	F1	G1	H1	J1	K1	L1	M1	N1	P1	Q1	R1	S1	T1	U1	V1
A2	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2	N2	P2	Q2	R2	S2	T2	U2	V2
A3	B3	C3	D3	E3	F3	G3	H3	J3	K3	L3	M3	N3	P3	Q3	R3	S3	T3	U3	V3
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A12	B12	C12	D12	E12	F12	G12	H12	J12	K12	L12	M12	N12	P12	Q12	R12	S12	T12	U12	V12

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MAIL IT NOW . . . *CARD EXPIRES OCTOBER 31, 1951

New Catalogs AND EQUIPMENT LITERATURE

Use one of the free and convenient Reader Service Postcards on this page to request copies of the catalogs in which you are interested.

Welding Fittings

"WeldOlets" welding fittings made by Bonney Forge & Tool Works are the subject of a new 32-page brochure. Typical installations are illustrated in the two-color book, and complete specifications are included. Also discussed are the company's "Thred-Olets" threaded fittings.

Circle No. 6 on Postcard

Lubricated Plug Valves

Piping, wiring, mounting and installation data for power operated Nordstrom lubricated plug valves are contained in a new Rockwell Manufacturing Company bulletin. Piping diagrams, arrangements for both side and top mounted motor controls, closing speeds, wiring data and photos of installations are included.

Circle No. 7 on Postcard

Adjustable Stairways

Lee C. Moore Corporation has available a four-page booklet describing its heavy steel adjustable stairways for derricks or masts. Engineering drawings are included. All standard sizes are listed for both one flight and two-flight stairs.

Circle No. 8 on Postcard

Drilling Rig

A 320-horsepower rig normally considered for drilling to 3000-5500 feet, and for servicing and workover at 6000-11,000 feet, the Ideal Type T-32, is described in a new bulletin by The National Supply Company.

Circle No. 9 on Postcard

Metal Marking

Parts identification, embossing, engraving and serializing are discussed in "Metal Identification Marking," a new leaflet issued by The Roberts Numbering Machine Company.

Circle No. 10 on Postcard

Surge Control

"Surge Control in Gas and Air Piping," a new Burgess-Manning Company bulletin, outlines methods of controlling surges by use of snubbers.

Circle No. 11 on Postcard

Chain Drives

"Installation, Operation and Maintenance of Chain Drives and Conveyors," a new bulletin by Chain Belt Company of Milwaukee, shows how to get the most service from sprocket chains. The text emphasizes proper installation, inspection, lubrication and adjustment.

Circle No. 12 on Postcard

WORLD OIL Reader Service POSTCARD **August, 1951, Issue***

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USE THESE CARDS To Get COPIES OF CATALOGS And for More Information on NEW EQUIPMENT ADVERTISED PRODUCTS

NEW AND IMPROVED EQUIPMENT

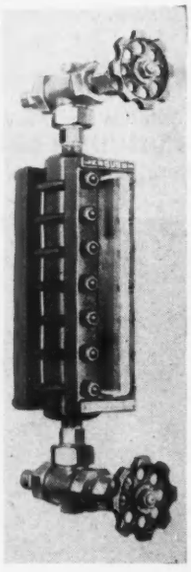
SUPPLEMENTING COMPOSITE CATALOG

KEEP INFORMED by requesting additional information on new equipment and services described on this and following pages. SAVE TIME by using one of the free and convenient Reader Service Postcards on opposite page. Circle number on card corresponding to the number listed at the end of each new equipment item on which you desire additional information.

Large Chamber Gauge

This item supplements Jerguson Gage & Valve Company data on page 2589 of Composite Catalog, 18th Edition.

Non-frosting large chamber gauges, series RLF-10 (reflex) or series TLF (transparent), made by Jerguson Gage & Valve Company, have the Jerguson gauge glass extension which prevents frost from forming over the vision slot, thereby permitting quick level reading of low temperature and low boiling point liquids. The gauge is particularly adapted to the gauging of low temperature, light, gaseous fluids that tend to boil or surge, because of the larger area at the meniscus—approximately three inches, as against .5 inch in the standard gauge. This results in less turbulence at the meniscus. In installation, the entire gauge may be covered with insulation, leaving only the outer surfaces of the non-frosting window extension exposed.

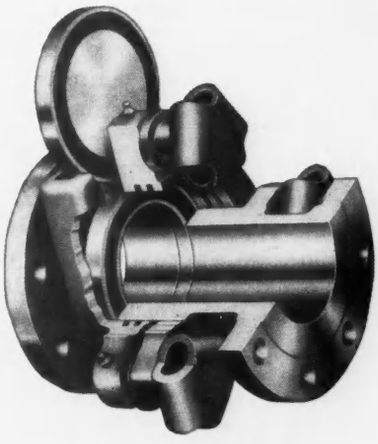


Circle No. 12 on Postcard

Line Blind Valve

This item supplements Hamer Oil Tool Company data on pages 2185-2216 of Composite Catalog, 18th Edition.

Hamer Oil Tool Company has available a new "Fluid Saver" type line blind valve which is spill-proof and self-aligning and has three-bolt operation. By turning the operating bolts with a short, straight bar, one man can release the spectacle plate, reverse it and seal it securely again. The two-piece body has telescoping hubs which slide one within the other, and have internal packing between them. Packing rings are recessed in the spectacle plate. Sizes available are from two to eight inches, with ASA 150-pound flanges.

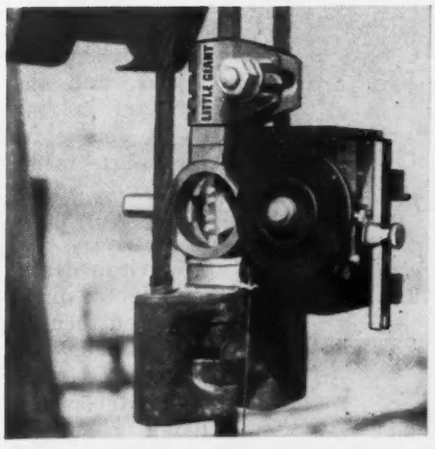


Circle No. 13 on Postcard

Dynamometer

This item supplements Johnson-Fagg Engineering Company data on page 2593 of Composite Catalog, 18th Edition.

The J-F Dynamometer, made by Johnson-Fagg Engineering Company, is used for operational control of pumping wells. By calculating the deflection of a steel proving ring, it measures and records the pumping load at every point in the stroke. It also measures counterbalance effect at the polished rod. It tells when the traveling valve in the pump opens on the downstroke, and gives an indication of the working fluid level, the weight of the fluid and the stability of the pumping operation. The instrument records unnecessary loads, which are the cause for a substantial number of mechanical failures, and measures horsepower being transmitted to the sucker rod string at the polished rod.

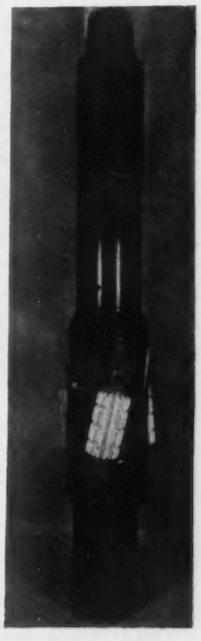


Circle No. 14 on Postcard

Reamer

This item supplements Grant Oil Tool Company data on pages 1953-1976 of Composit Catalog, 18th Edition.

Minimum number of part are used in a new reamer made by Grant Oil Tool Company. Designed for easy operation in stabilization and reaming out the hole to full gauge, the reamer is made of tough alloy steel forgings, heat-treated for added strength. It is streamlined to permit uninterrupted flow of circulation fluid, and cutters are so angled that weight must be applied to make the tool progress downward. It cannot, therefore, corkscrew itself into the hole. The reamer can be run with either end up, thus reducing the need for subs. Available are 3-, 6-, and 9-point models.



Circle No. 15 on Postcard

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

To obtain additional information use convenient Reader Service Postcard on page 79. Circle number on card corresponding to the number listed at the end of each equipment item on which more information is wanted.

Pipe Handling Equipment

This item supplements Byron Jackson Company data on pages 937-1036 of Composite Catalog, 18th Edition.

FIGURE 1

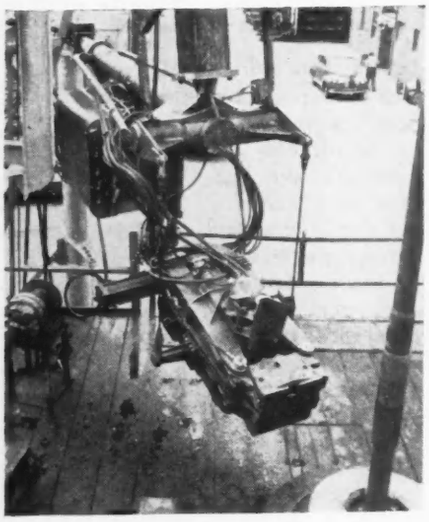
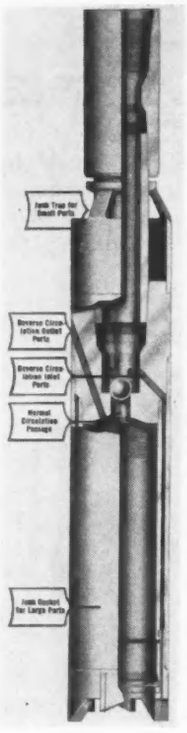


FIGURE 2

With new Byron Jackson Company power-operated equipment, round trips of drill pipe can be handled completely through power operation, all remote-controlled by three men and a score of knobs and levers. The equipment is intended for use in deep drilling operations which involve harder formations, frequent bit change, and more round trips involving long strings of pipe. The system includes a remotely-controlled racker which consists of two air motor-powered, chain drive racker units, one between the eleventh and 12th girts of the derrick, and the other just above the first girt. Each arm can be controlled for travel into and out of the working area of the derrick and is also track-mounted for full travel across the side of the derrick. The power elevator (Figure 1) is operated by compressed air controlled by the driller. Two air-actuating cylinders mounted on the traveling block deflect the block by means of wire lines from a carriage on the special derrick rail. Power-operated tongs (Figure 2) consist of two pipe-gripping units suspended from a telescoping arm clamped to the derrick leg. A master control console centralizes the power controls into one board. The system also includes the BJ Type B power slips.

Circle No. 16 on Postcard

Cone and Junk Catcher



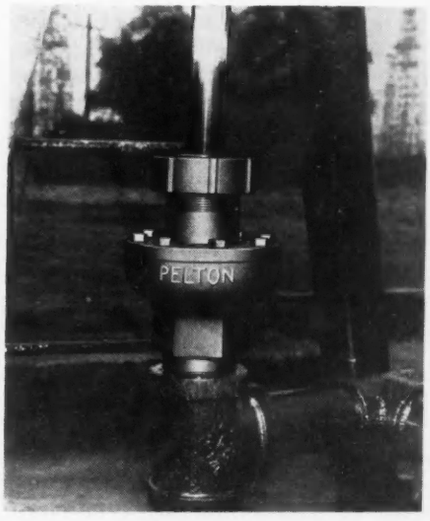
This item supplements Baash-Ross Tool Company data on pages 377-456 of Composite Catalog, 18th Edition.

The Costin cone and junk catcher made by Baash-Ross Tool Company consists of two separate "containers" — one for holding the rollers, bearings and other small pieces of junk, and the other for holding the bit cones and larger parts to be recovered. Small pieces such as bearings, rollers, etc., are first cleaned from the hole by direct circulation, then are collected in a junk trap with a solid bottom. Reverse circulation is carried to the bottom of the tool so that it jets directly upon the parts being recovered. Amount of circulation in each direction is under full control of the operator, permitting extra emphasis to be placed on recovering small parts or large parts, as desired, depending on the nature of the junk in the hole.

Circle No. 17 on Postcard

Wellhead Stuffing Box

This item supplements Pelton Water Wheel Company data on pages 4171-4178 of Composite Catalog, 18th Edition.



A new wellhead stuffing box made by Pelton Water Wheel Company compensates for polished rod misalignment, up to one inch. The upper portion of the box containing the packing floats horizontally on the smooth face of the lower body. A rubber O-ring provides the seal between the two sliding surfaces. Ring-type packing in the upper casting seals the polished rod against leakage. Both halves are made of high tensile strength bronze. Available for polished rods up to 1¾-inch diameter, the stuffing box has a three-inch external standard pipe thread at the bottom.

Circle No. 18 on Postcard

What Keeps <u>These</u> Compressors on the Job?

Wherever you put it, indoors or out . . . whatever task you give it, repressuring, booster service or air-gas lift . . . the Worthington HB Flare Gas Compressor will stay on the job.

There's real rugged construction in the one-piece frame, heavily ribbed inside, extended to include cylinder flange. Crankshaft, too—one-piece, counterbalanced, forged, heat treated, machined and ground to precision limits.

Or: take the valves. They're Worthington Feather* Valves, light-weight, but tight. No buffer plates or cushioning devices. The simplest valves made—no valve-grinding needed.

Add on such features as large-area one-piece cylinders, extra-large water jackets, forged steel semi-marine type connecting rods, anti-friction roller bearings, and automatic lubrication—and you've got a compressor that can take care of itself when the going gets rough!

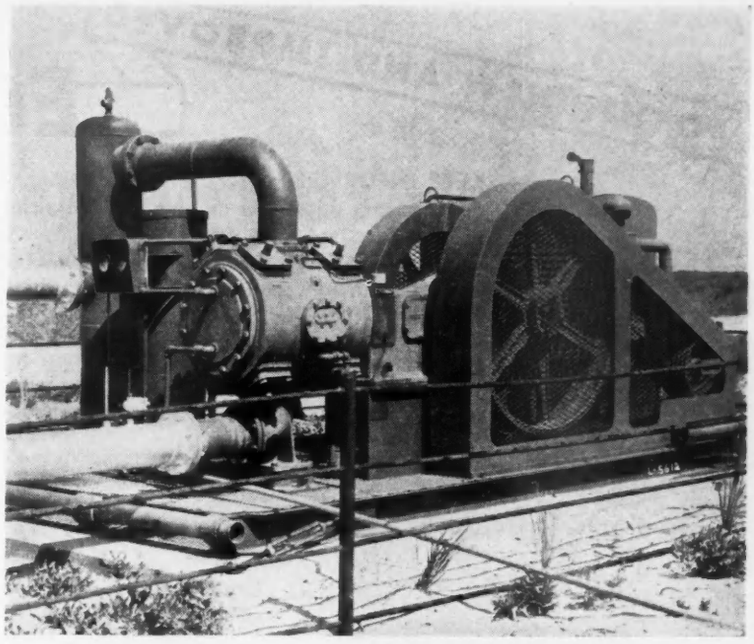
For good measure, each is equipped with QD Sheaves, originally developed by Worthington for oil field service.

WIDE RANGE AVAILABLE FROM LOCAL STOCK

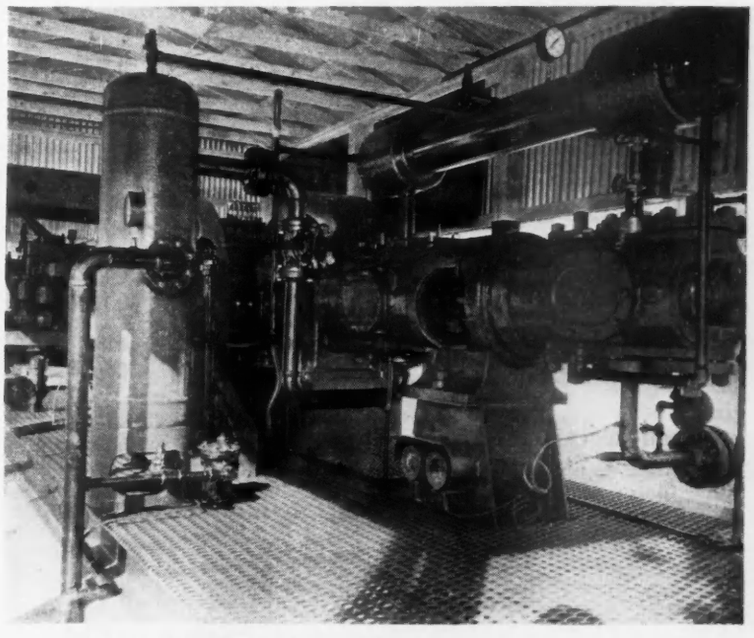
Worthington makes all sizes for any pressure range. Units available from stock in Tulsa, Houston, Dallas, Los Angeles—or from your local oil field distributor.

Have us send you Bulletin L-640-B1B, so you can see why *there's more worth in Worthington*. Worthington Pump and Machinery Corporation, Pump and Compressor Merchandising Division, Harrison, New Jersey.

*Reg. U. S. Pat. Off.



PORTABLE Worthington HB "Packaged" Flare Gas Compressor used by El Paso Natural Gas Co., Jal, N. M.



STATIONARY Worthington HB "Tandem" Gas Compressor, driven by engine. May also be motor-driven.

PC.1.12

WORTHINGTON

THE GOOD RIGHT HAND OF INDUSTRY

POWER TRANSMISSION: sheaves, V-belts, variable speed drives

PUMPS: centrifugal, power, rotary, steam

AIR COMPRESSORS: water-cooled, air-cooled

Worthington Pump and Machinery Corp.
Pump and Compressor Merchandising Div.
Harrison, N. J.

Send latest bulletin L-640-B1B on Worthington HB Flare Gas Compressor.

Name.....

Company.....

Address.....

City.....State.....

OTHER NEW AND IMPROVED EQUIPMENT

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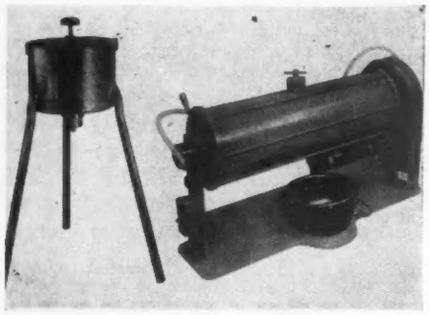
Gas Indicator

Portagas, a new portable gas indicator made by Atlas Exploration Company, detects and measures the hydrocarbons in drilling wells. It is designed for the geologist in the field, for use in drill stem tests, and drilling fluid sampling. The instrument weighs only five pounds and has dimensions of 10 x 4 x 3 inches. While any hydrocarbons may be detected, the instrument is calibrated on methane gas, and readings are instantaneous. The meter has a Hi-Lo sensitivity range; Hi for low gas percentages, and Lo for high gas percentages.

Circle No. 19 on Postcard

Mercury Cleaner

A large-size mercury oxifier and filter to clean mercury, made by Bethlehem Apparatus Company, has a capacity of 150 pounds and can clean mercury of dissolved base metals up to 600 pounds a day in 150-pound batches. When used with the Type H filter, it also eliminates floating impurities, such as water, oil, dust and acid residue.



Circle No. 20 on Postcard

Metal Protector

Corrosanti, an anti-corrosive made by the research laboratory of Dr. Adolph Schror, is a boiler and metal protector which reacts upon the metal treated but not upon the water surrounding the metal. Four grades are available: Grade A is for boiler metal surfaces; Grade B for ferrous metals subjected to deteriorating influences of water and water vapor; Grade C for metal surfaces subjected to acid and other highly corrosive vapors, gases, acid-forming conditions, salt water and brines; and Corrosanti Special for ferrous surfaces subjected to temperatures of 900° F.

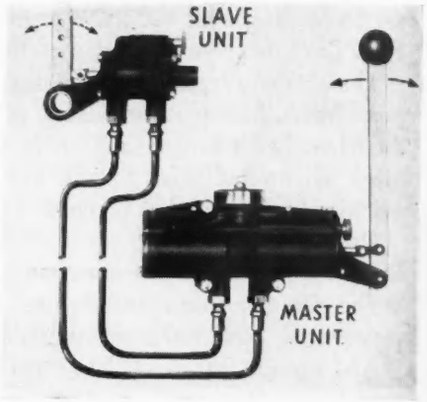
Circle No. 21 on Postcard

Welding Cover Plate

General Scientific Equipment Company's No. 125 all-plastic welding cover plate will not warp or crack, and offers clear visibility. The plate resists pitting from weld spatter and adds impact protection to welding filter plates. It will not discolor. The standard size is 2 x 4½ inches.

Circle No. 22 on Postcard

Remote Control System

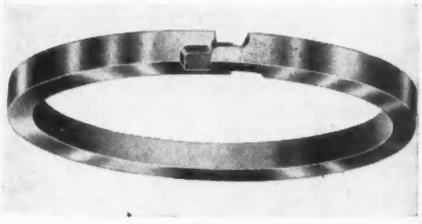


A new hydraulic remote control system, made by Superdraulic Corporation, consists of a master unit and a slave unit interconnected by two small tubes. Motion applied to the actuating lever of the master unit is accurately duplicated by the slave unit lever. It has positive load carrying ability in both directions because its operations is not dependent upon springs, compressed air or valves. The system provides for expansion and contraction of both fluid and metal due to temperature changes.

Circle No. 23 on Postcard

Sealing Ring

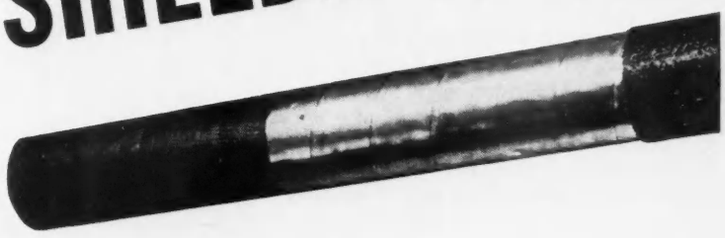
A new one-piece sealing ring with the sealing member on the inner side of the ring is manufactured by Double Seal Ring Company. The ring exposes only one material to the cylinder wall, thus helping to eliminate undue wear of insufficiently lubricated cylinder walls. The ring can be used in place of any presently used plain or sealing joint compression rings in two- and four-cycle gas and diesel engines, steam engines, air and gas compressors, pumps and hydraulic and pneumatic machines.



Circle No. 24 on Postcard

Power transmission to off-shore wells with the help of...

"326" MONEL SHIELDED CABLE



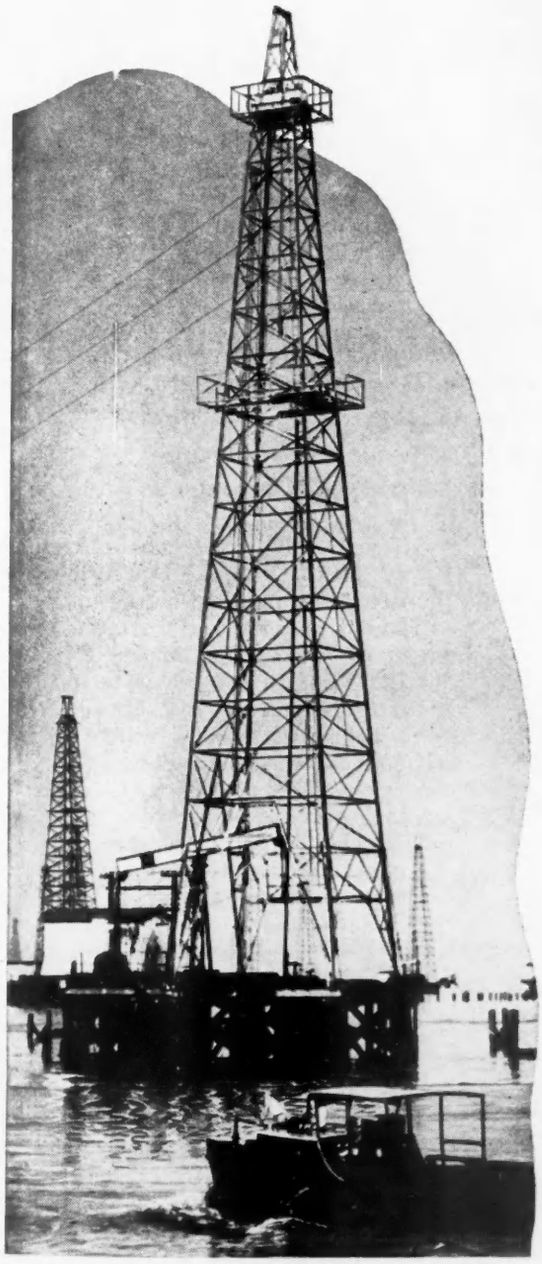


Photo by Vachon, courtesy Standard Oil Company (New Jersey)

Here's the kind of cable that stands up under the severely corrosive conditions of off-shore operation... either carrying power to off-shore wells, or to bottom-hole equipment in these wells.

It's called "326"® Monel Shielded Cable.

"326" Monel—a *non-magnetic* high-Nickel alloy—has many characteristics that make it an excellent shielding material.

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Because of these characteristics "326" Monel Shielded Cable is a natural for applications where maintenance is not only costly but inconvenient.

And here's another important point. This cable is economical in price. It costs no more than other good metal-shielded cable. In some types, it actually costs *less.*

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But there are some things we *can* do. One of them is to be Johnny-on-the-spot when you run into problems involving metals for oil field use. INCO's Technical Service welcomes the opportunity to work with you. Write for their suggestions and recommendations. Naturally, this assistance is yours for the asking—no cost, no obligation involved.

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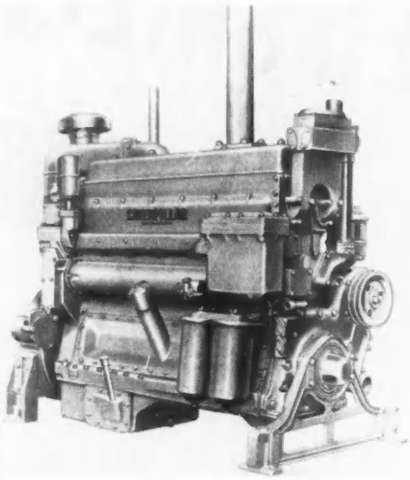

horsepower vertical gasoline starting engine is used with the new diesels.

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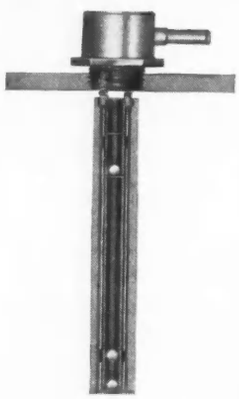

tion. The electrode in Model PN is a tube open at top and bottom. In the walls of the tube are wire conductors of electronic impulses. Within the tube itself are two hollow stainless steel balls. As the ball rises to the magnetic field in the casing, the electronic impact on the cathode in the vacuum tube in the control case is changed, thus operating the controlling relay.

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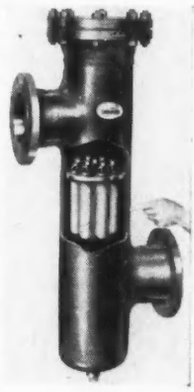

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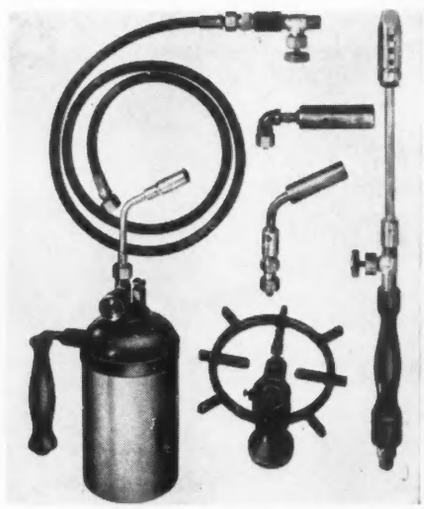

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Exploration Section

L. J. LOGAN, SECTION EDITOR

WORLD OIL

CHAPTER SEVEN in the Fascinating Story of the Search for Oil

In 1937 The gravimeter, which was placed in regular service in the United States in 1931, was widely used and generally recognized by 1935 as a superior exploration instrument. Its use increased rapidly and by 1937 the gravimeter had rendered the torsion balance practically obsolete. Many different types of gravimeters were developed and built during this period, and one that gained wide-spread usage was the Mott-Smith Gravimeter. This instrument consisted essentially of a horizontal quartz fiber carrying a horizontal weight arm which was connected to "labilizing" fiber which passed through the line of the horizontal fiber and attached to a spring. A small change in gravitational attraction of the weight arm produced a relatively large movement of it and of the index arm. This instrument, considered "quite small," weighed approximately 150 pounds. It was observed from a tripod which was let down through the floor of the truck. Thus, in general field operations, gravimeter stations were laid out along roads which could be reached by truck and the survey then consisted of lines of stations at intervals of ½ to 2 miles on roads that were approximately one to several miles apart.

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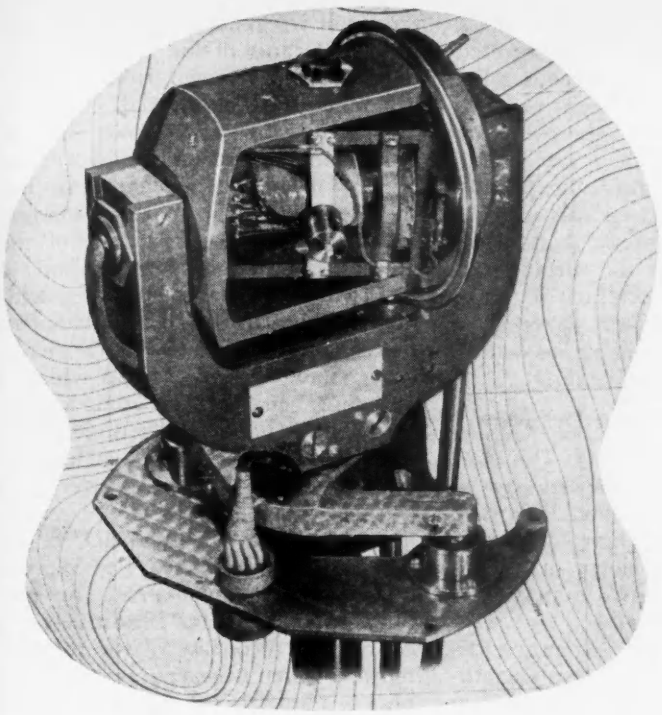

Evaluation of Magnetics In the Delaware Basin

By H. WAYNE HOYLMAN
Geophysical Consultant
Los Angeles

DURING the past 20 to 25 years many attempts to evaluate a magnetic map have been made by hastily spotting dry holes and producing areas on it. After this a still hastier count of the dry holes on the magnetic highs and the number of producing areas in the so-called magnetic lows is made. From such a compilation the earlier investigator has generally concluded that there is no correlation and still worse that the magnetics were of no value in helping to determine prospectable areas for production. Such a procedure is deplorable and is definitely not the way to evaluate either magnetics or gravity.

If one examines carefully the vast number of so-called magnetic surveys which have been made in the petroleum industry during the past 25 years, one runs into the very astounding fact that the majority of these surveys are of such a low grade or quality that they are of little value; as a matter of fact, they are generally practically worthless. Furthermore, efforts to interpret geology from such low grade surveys has without and doubt given rise to more misinformation and even misinterpretation than, perhaps, any other single thing. It is not surprising, therefore, that many geologists and geophysicists view the magnetic method of prospecting with much skepticism.

To make a reliable and worthwhile evaluation of the magnetic survey such as exists today in the Delaware Basin three basic steps should be followed:

1. Determine the accuracy and reliability of the survey.
2. Select anomalies in the survey and predict geological conditions related, especially, to the basement on the respective characteristics of individual anomalies.
3. Where possible, check carefully the predicted geological conditions with the known geological facts within the limits of the survey to determine the reliability of the magnetics in helping solve geological problems.

To determine the accuracy and reliability of magnetic surveys it is necessary to subdivide them into ground and airborne magnetometer surveys. In the case of the ground magnetometer the accuracy and reliability must be determined from five basic points which are as follows:

1. Scale constant of field and base instrument.
2. Method by which the diurnal has been recorded.
3. Working range of field instrument around the diurnal base instrument.
4. Variation of intensity resulting form offset stations.
5. The accuracy of geographical positioning of the magnetometer readings.

The first three points are necessary in determining the accuracy of the survey while the latter two have direct control in determining the reliability of the survey.

Figure 1 shows the most accurate ground magnetometer survey that can be made in any part of the Delaware Basin. In reviewing the field notes of this survey in accordance with the points listed above it is possible to determine the accuracy and reliability of the survey.

1. The scale constant of the field and base instruments used were less than five gamma per scale division. This small constant permits the making of observation accuracy to within plus or minus 1.0 gamma.
2. The diurnal was recorded at ten-minute intervals during the time that the field instruments were in operation.
3. The working range of the field instrument around the base station never exceeded a 30-mile radius. Furthermore, the field instrument checked out in the morning and back in in the evening at the base station as well as checking at subbase stations in the field at one hour intervals during the day. The checked readings on the base and subbases were within plus or minus 1.0 gamma.

From this information the survey has an accuracy of plus or minus one gamma and is unquestionably as ac-

ALTHOUGH MANY magnetic surveys have been made during the past 25 years, a high proportion are of low quality and little value, causing many geologists and geophysicists to view the magnetic method of prospecting with skepticism. However, magnetic surveys made in the Delaware Basin of West Texas can be helpful in the interpretation of the geology of the area if properly evaluated and studied.

curate a ground survey as can be made in the Delaware Basin.

The reliability of this or any ground survey is determined from the magnetic difference from station readings taken from 50 to 100 feet apart.

In Figure 1 it is to be noted that in many places there are several readings at a station location. Furthermore, the differences between the readings vary from 5 to 50 gamma with the average approaching about ten gamma.

This means, therefore, that while the accuracy of the survey is good to plus or minus 1.0 gamma, it is ten times less reliable as related to or reflecting geological conditions in or on the basement complex.

In the Delaware Basin, where the basement varies from 5000 to 20,000 feet below the surface, the majority of anomalies reflecting probable relief in the igneous basement are from three to five and at the most ten gamma. The really significant point is, therefore, that anomalies in a ground survey cannot be interpreted as reliable reflection of igneous relief in the basement which might produce structural conditions in the overlying sediments, because they are within the noise level or unreliable part of the survey. Inasmuch as this unreliability is due to magnetic float material on or very near the surface outcrops, it becomes necessary to make airborne magnetometer surveys, if surveys are to be reliable to within plus or minus 1.0 to 2.0 gamma.

Airborne Survey in the Delaware Basin

Figure 2 shows the airborne survey of the same area in the Delaware Basin as the ground survey in Figure 1. This survey was flown at a constant elevation of approximately 1000 feet above the ground.

The most obvious difference between the two surveys is the smoothness of the ten gamma contours in the airborne survey as compared to the small irregularities in the ground survey. Because of the great depth to the basement, known from drilling, it is obvious that the small one point highs and lows as shown in the ground magnetometer survey are not related to basement conditions but rather to magnetic material existing in or very near the surface of the ground. The vertical dimension of this float is such that it does not influence the airborne instrument; therefore, the aeromagnetics give a very reliable magnetic map which is reflecting, in general, the igneous basement beneath the sediments.

From inspection of the field notes connected with this survey, it is learned that the airborne magnetometer used was the type that is suspended from a plane. The repeatibility and instrument response produces magnetometer readings on a continuous recording of the total intensity, which are accurate to within plus or minus 1.0 gamma. Due to the large-scale reading on the continuous

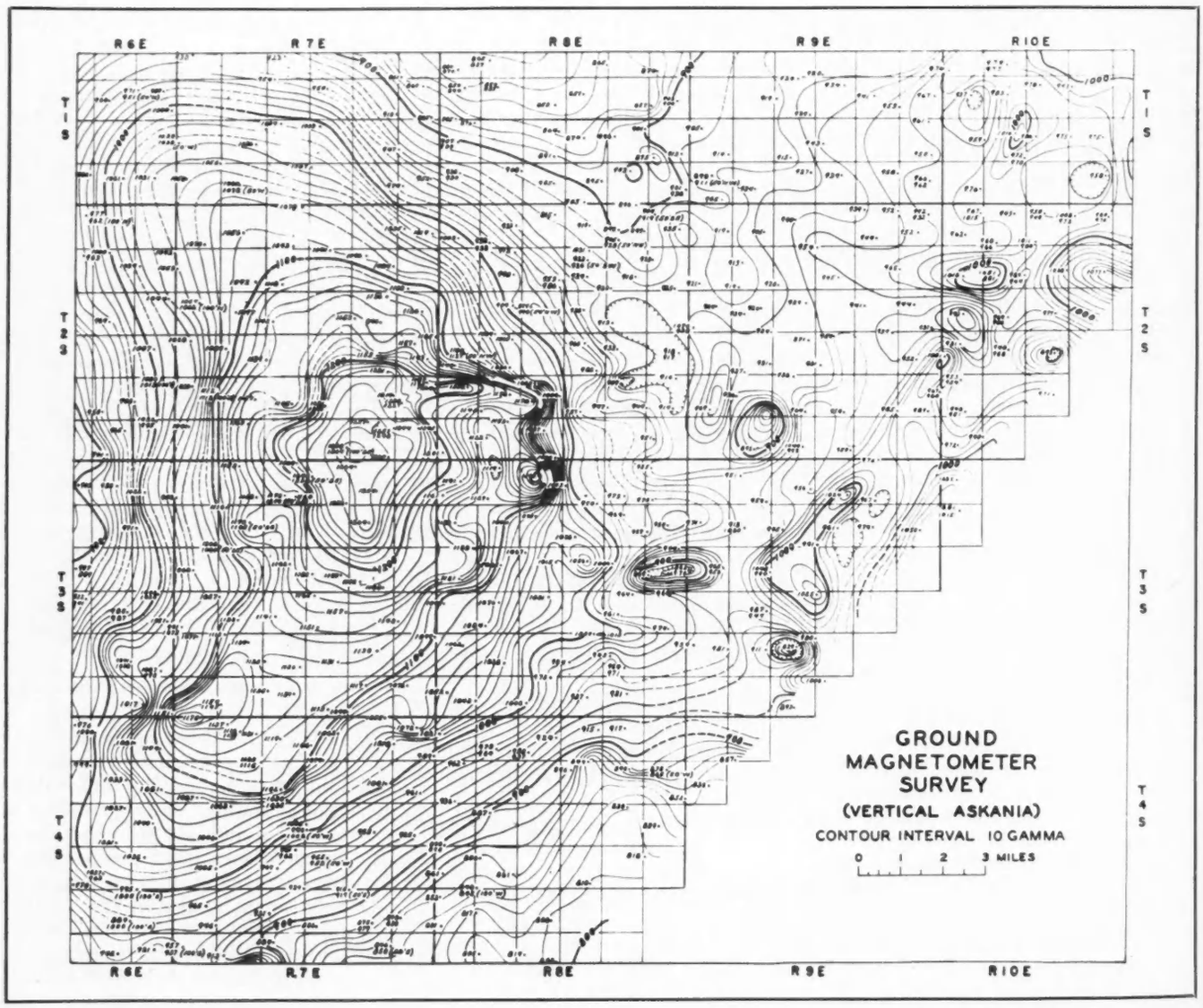

FIGURE 1. Ground magnetometer survey with an accuracy of ± 1.0 gamma but with reliability of only ± 5.0 to 7.0 gamma.

recording record the intensity can actually be read to plus or minus 0.3 gamma. This accuracy is, however, better than the reliability of airborne surveys.

Due to the inherent design of the airborne instrument it is not possible to reliably hold its drift consistently to plus or minus 1.0 gamma or less. Seldom do two instruments have the same linear drift; consequently, it is not possible to operate an airborne instrument as a base instrument and use the observed intensity from the base instrument to correct the field data for removal of diurnal.

To date it has not been possible to use any diurnal base instrument to correct airborne field data. Because the airborne data are total intensity it is necessary to have a base instrument that records the total intensity or else observe the horizontal and vertical components of the earth's magnetic field. These can then be combined to get an accurate determination of the variation of the total intensity, but even this curve cannot be used for the actual diurnal correction of the airborne magnetometer data.

Figure 3 shows how the horizontal and vertical components vary on three different days, September 5, October 5 and 28, 1950. The horizonal and vertical scales are such to permit one gamma accuracy in reading of this type of base instrument observation. On these three days the vertical component is, in general, more linear than the horizonal component. It is to be especially noted that the horizontal observed diurnal is oscillating rather frequently and passes either a minimum or maximum at less than 15-minute intervals.

Actually it is this non-linearity of diurnal that causes unreliable airborne surveys. The five to ten gamma oscillation in the diurnal in 10 to 15 minutes as shown in the previous curves in Figure 3, will produce erroneous anomalies in the airborne survey. Such errors may be of a shape as to be indistinguishable from anomalies reflecting igneous conditions in the basement. If, however, the proper type of base-loop system is flown within the limits of the airborne survey, about 97 per cent of the normal non-linearity of the diurnal can be removed.

This will permit the reliability of the survey to approach plus or minus 1.0 to 2.0 gamma or the instrumental accuracy, whatever it may be.

Base Loop System

From many years of studying the diurnal, it is known to be linear for periods of approximately ten minutes. This means that such a time period must be the controlling element in the loop pattern such as is shown in Fig-

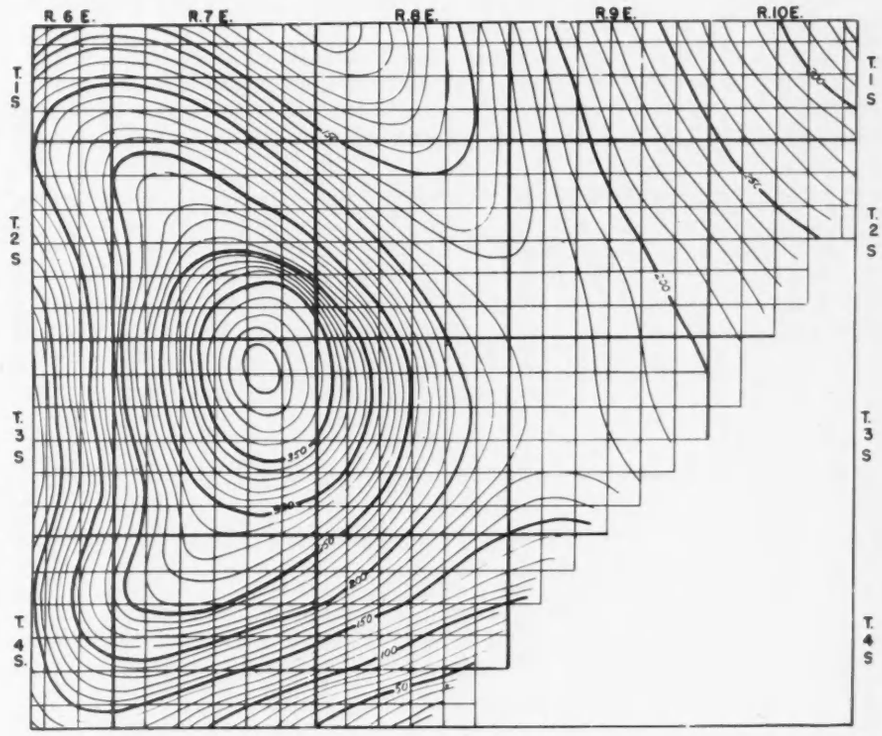

FIGURE 2. Airborne magnetic survey with an accuracy of ± 1.0 gamma, and with a reliability ± 1.5 gamma.

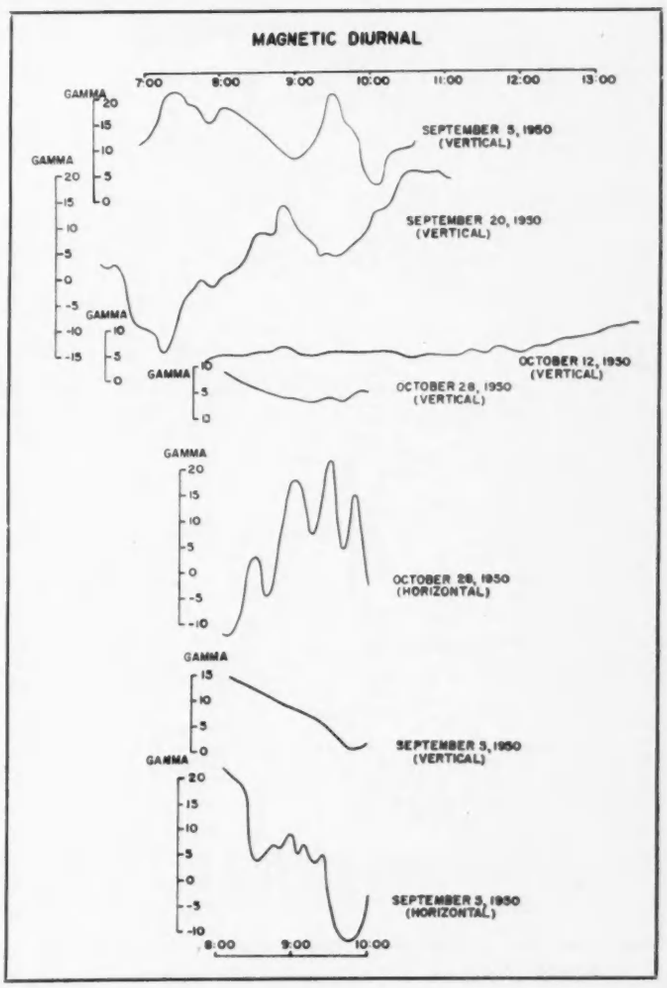

FIGURE 3. Magnetometer diurnal variations of the horizontal and vertical components of the earth's field.

ure 4. On the left hand side, Figure 4, plate II, is shown the three-pass type of base loop which is normally flown around the perimeter of a small survey 30 by 50 miles or the subdivision of a large survey. The aircraft flight procedure of obtaining this three-pass system is executed as follows:

The flight starts at TP1 (turning point) and flys for eight to ten minutes toward or to TP2, at which point a 180-degree turnaround is made and the aircraft returns to TP1 after which another 180-degree turnaround is made and the aircraft returns to TP2. This routine completes the three-pass loop and the aircraft will then proceed to TP3 and repeat the three-pass loop procedure between TP2 and TP3. This looping is continued around the perimeter until the loop pattern is closed at TP1. The most reliable results are obtained when the three-pass loop is flown along the identical track between turning points.

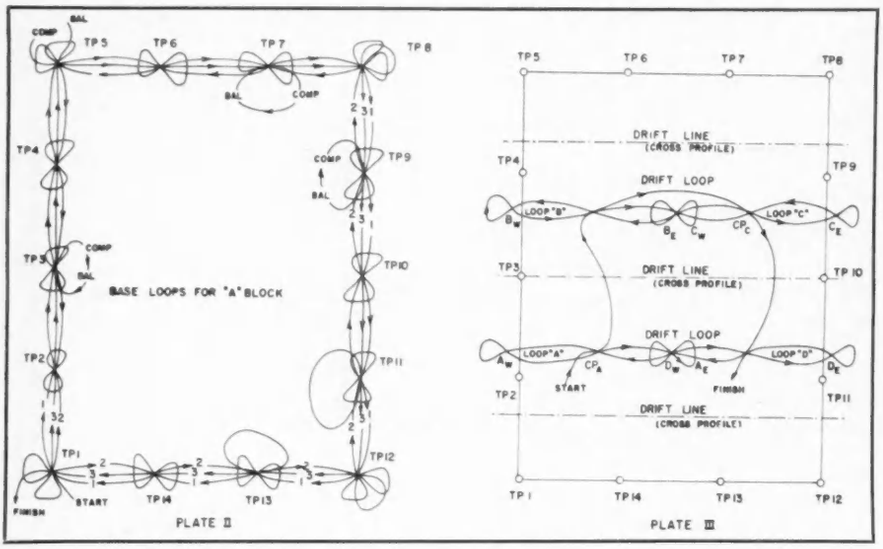

FIGURE 4. Loop-systems for airborne surveys comprised of three-pass base loops and two-pass drift loops.

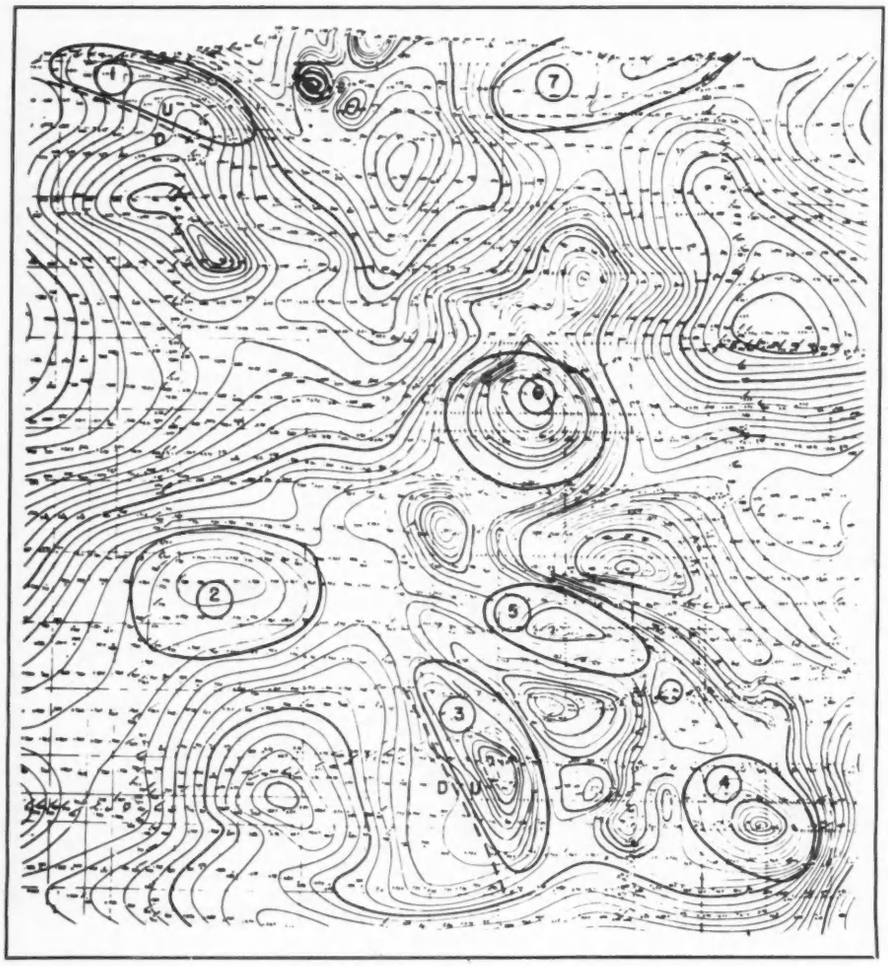

FIGURE 5. Airborne magnetic survey with anomalies reflecting shallow basement.

In order to control the drift along the individual profiles flown north-south in a block such as shown in Figure 4, it is necessary to subdivide the block or survey into parts by flying two-pass drift loops as shown in Plate III of Figure 4.

When the two portions of the loop system are flown as indicated by Figure 4, and the time element is kept to not greater than ten minutes, a reliable airborne survey results—provided, of course, the geographical positioning of the profiles is within plus or minus 100 to 150 feet. This precise positioning can be obtained from either shoran control or radially controlled mosaics.

In the case of the airborne survey in the Delaware Basin proper, it is shoran controlled and is, therefore, as accurate a ground control as can be obtained for magnetic surveys.

Another thing which influences the reliability of a survey is the spacing or interval between profiles. For the most reliable surveys, the horizontal distance between profiles should be approximately one-half the average distance between the survey flight elevation and the average depth to the basement. When greater spacing than this is obtained it is often difficult, if not impossible, to determine errors in the survey that are not related to basement conditions.

A careful inspection of component parts shows the airborne survey in the Delaware Basin to be accurate to plus or minus 2.0 gamma. The reliability is also of the same order of magnitude. The ground survey, while accurate to plus or minus 1.0 gamma, is not reliable to less than plus or minus 5.0 to 7.0 gamma. The outstanding point about the airborne survey is its increased reliability.

Selection of Anomalies

Figures 5 and 6 show the variance of anomalies which may exist in the Delaware Basin proper and around its perimeter. In general, Figure 5 reflects, relatively, a shallow basement while Figure 6 reflects a much

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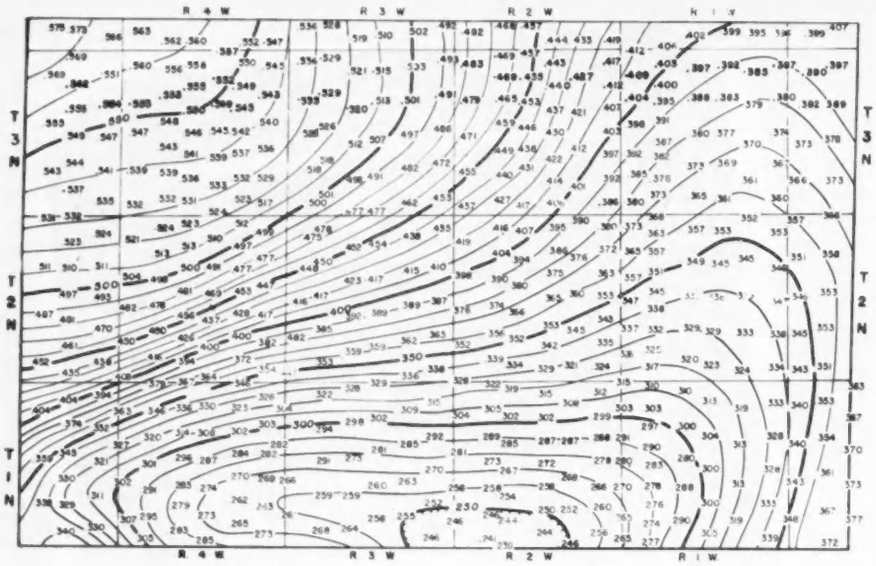

FIGURE 6. Airborne survey with anomalies reflecting deep basement.

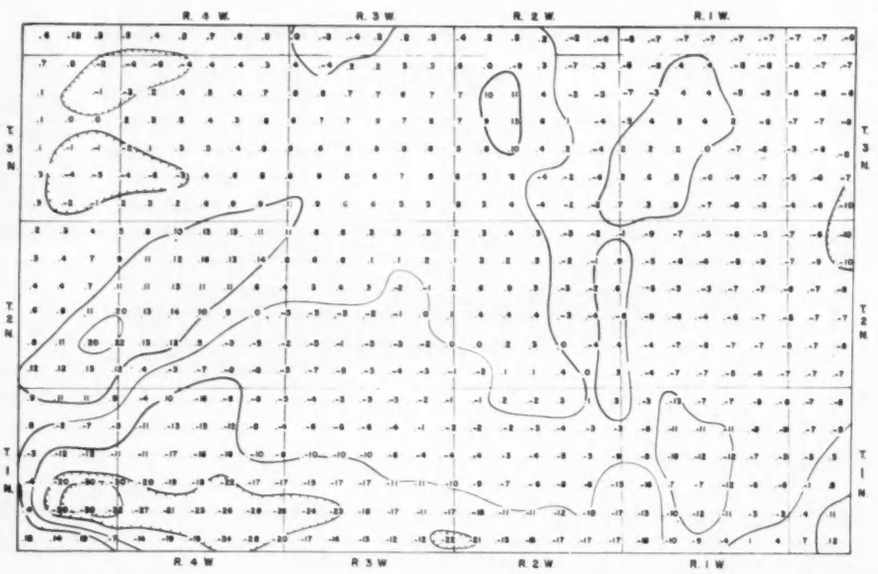

FIGURE 6-A. Residual type map derived from aeromagnetics Figure 6 and contoured to ten arbitrary units.

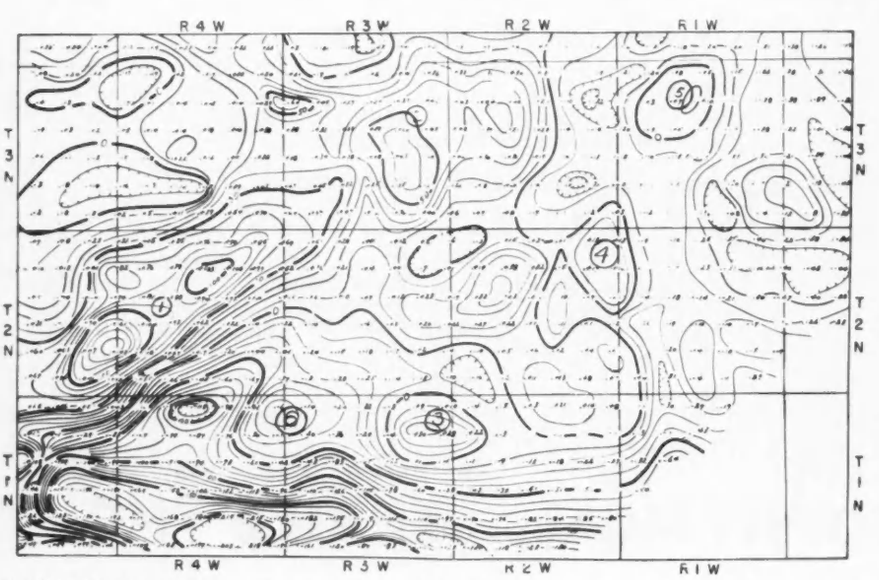

FIGURE 6-B. Special derivative contour map from aeromagnetics Figure 6 and contoured to ten arbitrary units.

deeper basement which is, perhaps, twice the depth below the survey level as the area in Figure 5.

The magnetic characteristics of the seven anomalies in Figure 5 suggest geological conditions associated with igneous rocks as follows:

1. Regionally, anomalies 1, 2 and 7 reflect a greater depth to the igneous rock than anomalies 4, 5 and 6. These latter anomalies could be reflecting extrusive flows while the former reflect intrusive or basement rocks.

2. Anomaly No. 2 reflects igneous relief that is domical in shape as might result from igneous exposure to an extended period of erosion. Anomaly No. 7 may be reflecting a somewhat similar igneous condition but presumably less domical in shape.

3. Anomaly No. 3 appears to reflect a shallow igneous condition at its apex while the periphery, especially the western part, is reflecting much greater depth to igneous rocks, perhaps basement. The western side of this anomaly appears to be faulted in a manner such that a high closure may exist, again the fault on the down-thrown side. A more reliable evaluation of the anomalies could be made, were a derivative map computed from the observed data.

From an inspection of the contours on Figure 6, it is obvious the basement is at considerable depth below the flight elevation of the survey. Anomalies in this type survey show up as merely squeezes in the contours. To determine the areal extent of any anomalies in a survey such as this, it is necessary to compute either a residual type of map or, better still, a derivative map in accordance with Peters' theory.

Figure 6A shows a residual type or approximate second derivative map derived from the aeromagnetics in Figure 6. The chief difficulty with this map is, while it shows some magnetic highs, the anomalies have no character and appear very uninteresting. As a matter of fact, the anomalies are so unattractive it is difficult, if not impossible to get an exploration manager to approve additional geophysical investigation such as seismic work across the various anomalies.

There are, however, several attractive anomalies in the survey when the proper type of derivative map is computed. The "special" derivative map, Figure 6B, has been computed from the same work map as Figure 6A, but the special computations, requiring accurate and reliable data, sharpens the anomalies to the point where they take on character and become attractive as geophysical prospects worthy of further investigation by seismo-

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graph. Furthermore, the anomalies can be classified and should be shot in the numerical order shown.

If faulting exists around anomaly No. 1, it would be best to look first along its southeastern slope.

As for the No. 2 anomaly, faulting has the best chance of occurring along its west side.

A regional type fault may exist along the south side of anomalies Nos. 3 and 6.

From a comparison of maps 6A and 6B, it is at once obvious that the main purpose of a derivative map is not merely to outline magnetic highs but rather to give them sufficient character so that the attractive details become apparent and permit a classification of the anomalies as to probability of their reflection of igneous relief in the basement which may be overlain by structure in the sediments. Unless the aeromagnetic survey is both accurate and reliable, a dependable derivative map is not justified and is often misleading when unreliable data are used.

Correlation

Whenever an evaluation of magnetics is made by correlation of predicted geological conditions with known geology, the investigator should make certain that the geology used to check the magnetics is factual and not just a geological opinion. Actual correlation of magnetics with geological facts in the Delaware Basin proper is today sufficiently meager that no conclusive evaluation is advisable even if reliably possible.

The writer knows, however, of four anomalous areas in the airborne survey located around the periphery, but definitely in the Basin, which have been checked with seismograph and structural conditions have been found. Although the records are not altogether sufficient, they definitely show the existence of structure at about the Ellenberger position in the lower Paleozoic section.

This first bit of seismic evidence does suggest that aeromagnetic surveys do reflect basement conditions overlain by structure.

In going into the deeper parts of the Basin, it is expected that the best results will be obtained in those areas where the original surveys are refined further by the derivative maps.

About the Author

H. WAYNE HOYLMAN has been active in geophysical work for 20 years. From 1930-48 he was with Gulf Research and Development Company, specializing in interpretation of ground and airborne magnetics and seismic data. Last year he resigned as chief geophysicist from Fairchild Aerial Surveys, Inc., and opened his own geophysical consultant service in Los Angeles, specializing in the coordination of geophysical and geological interpretations.

Figure 7 shows the areal extent of the aeromagnetic surveys which exist in the Delaware Basin and vicinity. For those who wish to determine for themselves the correlation between anomalies and, at least, surface geology which may be in part reflecting basement conditions, it is recommended that they purchase the aeromagnetics to the west and south of the Guadalupe Mountains as indicated in Figure 7. In this part of the survey, which is shoran controlled, there are numerous mountain ranges both intrusive and extrusive, with accompanying faults and folding which show interesting correlations. The fact that the aeromagnetics survey covers the entire area, with profiles spaced approximately one mile apart, makes it one of the most comprehensive surveys for studying correlation with geology that now exists.

Conclusion

If, however, one considers the correlation of anomalies with factual geology to the east of the Delaware Basin on the Central Basin Platform, the writer has found that anomalies have a one to three correlation with subsurface structures for those surveys which are accurate and most reliable, even though for the most part they are ground surveys. A reasonable deduction is, therefore, that the airborne magnetics with their increased reliability, such as exist in the Delaware Basin, should be extremely valuable in calling attention to prospectable areas, perhaps, the ratio of anomalies to Ellenberger will approach three out of four, at least, in the shallower parts of the Basin.

In the deeper parts of the Basin the correlation may be less because the size of the anomalies approach errors resulting from geographical positioning. These errors are, however, held at a minimum in aeromagnetic surveys which are shoran controlled.

The important point is that where the best interpretative results have been obtained from aeromagnetics more than one derivative picture is required.

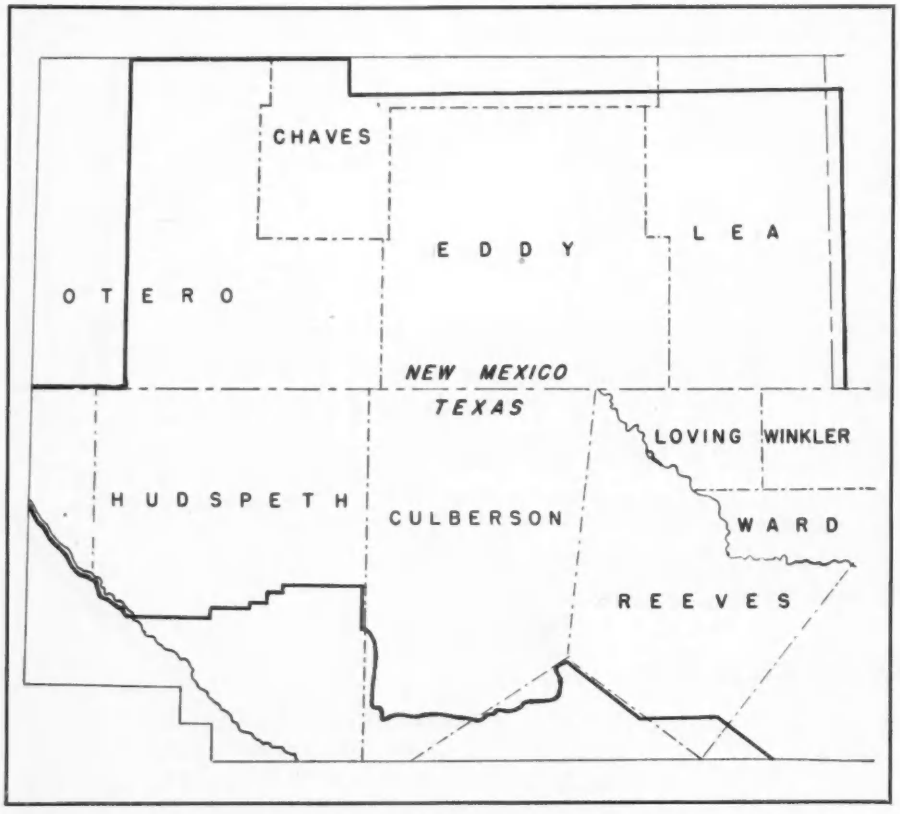

FIGURE 7. Areal extent of airborne magnetometer survey of Delaware Basin and vicinity.

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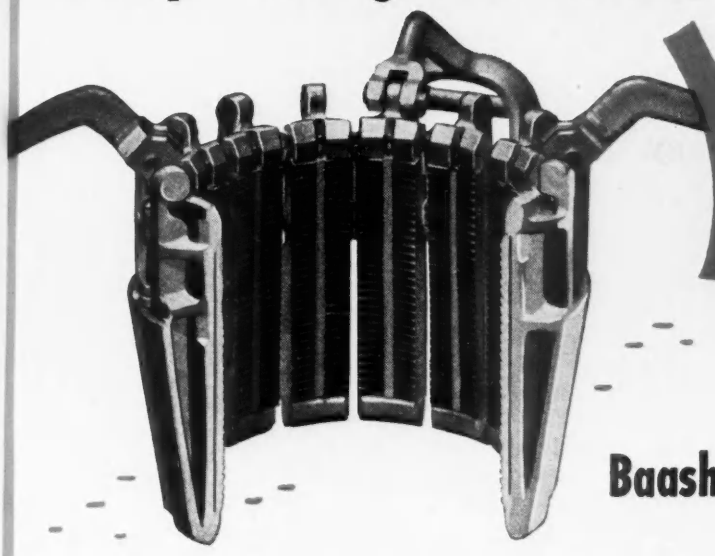

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EASTERN KANSAS
Developments and Prospects

By DR. JOHN MARK JEWETT

State Geological Survey, University of Kansas, Lawrence, Kansas

PROSPECTS for increased oil production in eastern Kansas, especially from the deeper pre-Pennsylvanian rocks, were discussed by the writer in WORLD OIL for May, 1950, pages 64-70. Attention was called to the discovery of the Viola limestone Davis Ranch pool in Wabaunsee County in the spring of 1949 by The Carter Oil Company and to the somewhat feverish activity that had followed. Surface mapping once more became the accepted method of initial attack in looking for promising areas when several major companies brought in field men with experience in the Rocky Mountain country. Plane table mapping, core-drilling, and seismography studies still are in progress in the broad synclinal area east of the Nemaha Uplift.

The prediction was made in the earlier article that, in spite of the somewhat discouraging string of failures during the year then past, other important pools would be found in the deep rocks. The stratigraphy and structure of Wabaunsee County and adjacent parts of eastern Kansas merit special attention and the 1950 record shows that optimism was justified. The results of the past year's activities are reviewed here. Locations of recent significant discoveries are shown in Figure 1.

The Davis Ranch field was opened by Carter's Davis 1-"A," SW SE SW 33-13s-10e, in May, 1949. Initial daily production was rated at 2580 barrels of oil per day. The reservoir is in the upper part of the Viola limestone (for a somewhat comprehensive discussion of the geology of eastern Kansas, reference is made to Kansas Geological Survey Bulletin 77) at 3199 feet where its eroded surface lies below the Maquoketa shale. The test was on a structure, now known as the Davis Ranch anticline, that was mapped on outcropping rocks. Closure measured on surface rocks in the small fold is reported to be about 20 feet. Drilling has revealed that the structure increased in size with depth, that closure on the Viola limestone is about 100 feet, and that a fault cuts subsurface formations probably as high as rocks of late Pennsylvanian age on the east side of the anticline.

A detailed report on the geology of the Davis Ranch area, by R. Kenneth Smith and Ellis L. Anders, Jr., of the State Geological Survey of Kansas, is in press. The Davis Ranch field has 17 producing wells in Sect. 33-13s and in Sect. 4-14s-10e. In 1949 the field produced 46,659 barrels of oil and the next year, 259,709 barrels.

In January, 1950, the Davis Ranch East field was opened when Aladdin Petroleum Corporation's Schutter 1, SW SW SW Sect. 34, found Viola production in a zone from 3305-14 feet on the downthrown side of the fault in the east flank of the Davis Ranch structure. Reported production in 1950, March to December inclusive, was 7593 barrels of oil.

In early autumn two other fields were opened in Wabaunsee County. Seemingly they with the Davis Ranch are on a long fold paralleling the Nemaha Uplift, with the oil pools in higher parts of the elongated structure. The Mill Creek field was opened by Skelly Oil Company's Throwe 2 in SW NE NE 2-13s-10e, about six miles north of the Davis Ranch area. The reservoir there, in the upper part of the Viola limestone, is between 2923-37 feet. During the last three months of the year, 6905 barrels of oil were produced from the discovery well.

The Newbury field is about 12 miles north and slightly east of the Mill Creek and is on the same trend. The discovery is Skelly Oil Company's Ferguson 1, NE SW NE 11-11s-11e. The upper Viola limestone reservoir lies between 2901-04 feet. Three months' production in the last part of 1950 was 3459 barrels of oil. In February, 1951, Carter discovered another Viola pool in Wabaunsee County. It is the Woodbury in NE 11-15s-10e.

THERE ARE numerous areas of Eastern Kansas where wildcats drilled after thorough geologic investigation should open new pools. Prospects for increased oil production in Eastern Kansas involve especially the deeper pre-Pennsylvanian rocks. Stratigraphy and structure of Wabaunsee County and adjacent parts of Eastern Kansas merit special attention and the record of discoveries for 1950, here reviewed, shows that optimism has been justified. This article is published by permission of the State Geologist.

Discoveries on Same Trend

Other pool discoveries are deemed significant. One is in Lyon County not far south of the Davis Ranch field and one is about 85 miles north and slightly east in Nemaha County. Both are in geologic settings similar to that of the granite ridge of the Nemaha Uplift.

In April last year Stanolind Oil & Gas Company and Winkler and Koch completed Cornwell 1 in NE NE NE 26-16s-10e. Production there is in the Hunton limestone in a zone between 2950-67 feet. The discovery was rated at 257 barrels of oil per day. During the remainder of the year 4334 barrels of oil were marketed from the well. The Bushong field, which was opened by the Cornwell discovery is in Lyon County about 18 miles southeast of the axis of the Nemaha Anticline and

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about 15 miles south of the Davis Ranch. This pool seemingly is in about the deepest part of the broad trough that parallels the uplift on the east. It is not clear whether the pool is on the southern extension of the Wabaunsee County structure or on a fold parallel with it. The top of the Mississippian limestone was reached in the discovery well at 2471 feet and the Hunton limestone that comprises the reservoir lies at 2950 feet below the surface.

In October, 1950, Carter's Oren Strahm 1, in NW SW NW 13-2s-14e, Nemaha County, found production in the Hunton limestone and opened the Sabetha field. The reservoir is in the upper part of the limestone, which lies disconformably below the Chattanooga shale, and is between 2826-34 feet.

Hunton production had been established earlier in the Strahm field in Nemaha County and in the neighboring Falls City, Nebraska, area. The Strahm discovery, in the center of SW SW NW 27-21s-14e, in September, 1948, marked the discovery of oil in the deep western part of the Forest City basin in Kansas. Of greater significance, then, is the recent discovery of a deeper pool, in Viola limestone, in the Strahm field. This took place when Carter's Mamie Strahm 2, northeast offset of the Hunton discovery well, reached Viola production between 3559-78 feet.

Other recent discoveries in eastern Kansas are worthy of attention. Some are regarded as the normal results of development, but others resulted from a more general consciousness of possibilities in favorable structures in deep rocks and are of special interest. In January this year, a Simpson pool, the Fourmile Creek, was discovered in Butler County, when William L. Graham and J. P. Graty's Graham 1-A in SW SE NE 5-28s-3e, was completed for 2068 barrels of oil per day. Two Pennsylvanian pools were discovered in Butler County last year. The Muddy Creek, a Bartlesville sand pool, was opened in May in 13-29s-4e. During the remainder of 1950 production from the new field amounted to 14,215 barrels of oil. The Hartenbower is in the Peru sand pool, 16-29s-6e. The field was opened in August and the 1950 production was 2147 barrels of oil.

In Cowley County, Arbuckle production was revived last year in the Bruce field, 9-30s-4e. The pool had been discovered in 1941 and production in the revived field in 1950 amounted to 2284 barrels of oil. In June, 1950, Arbuckle production was revived in the Fleming field, in the northern part of 29s-9e. During the remainder of the year, 4269 barrels of oil were produced in the field. The Ferguson Northwest, a Kansas City lime pool, 16-30s-8e, Cowley County, was discovered in December, 1949.

Greenwood County had two Mississippian discoveries last year. The Honey Creek field was opened in August by C. W. Darling's Johnson 1, N½ SE SE 32-26s-11e. Estimated production of 30 barrels of oil per day was reported from between 1871-79 feet. E. L. Edwards' Kimball 1, opened the Morris field in NW NW 28-24s-13e. The discovery was completed in September. The reservoir is between 1671-76 feet.

A Viola limestone pool was found in Marion County. It is the Cedar Creek, discovered by R. Gear's Robinson 1, SW SW NE 31-20s-5e, completed in June. During the remainder of the year 1246 barrels of oil were produced from the field. Recent openings of two fields in Morris County emphasize the widespread possibilities in the Mississippian limestone and "chat." The Threemile field was opened in June last year. The discovery well is in SW NW SW 25-16s-5e. The well was rated at 40 barrels per day. The reservoir is in the upper part of Mississippian rocks between 2208-52 feet. Later in the year the Threemile Creek South was opened by R. Larioux's Gross 1, in Sect. 35 of the same township. During the last seven months of 1950 the Threemile Creek field produced 12,458 barrels and during the last three months of the year the Threemile Creek South produced 2967 barrels of oil.

Recent developments in Montgomery County strengthen possibilities of Arbuckle production in the Chautauqua arch area where the Chattanooga shale lies on eroded Arbuckle beds. In 1949 an Arbuckle pool was discovered in the old Brewster field, W½ 4-32s-16e. At least one well is reported to have had an initial daily potential of about 1000 barrels of oil. Apparently the pool is in a structure of considerable closure with a pay zone of as much as 25 feet in the crest. Seven producing

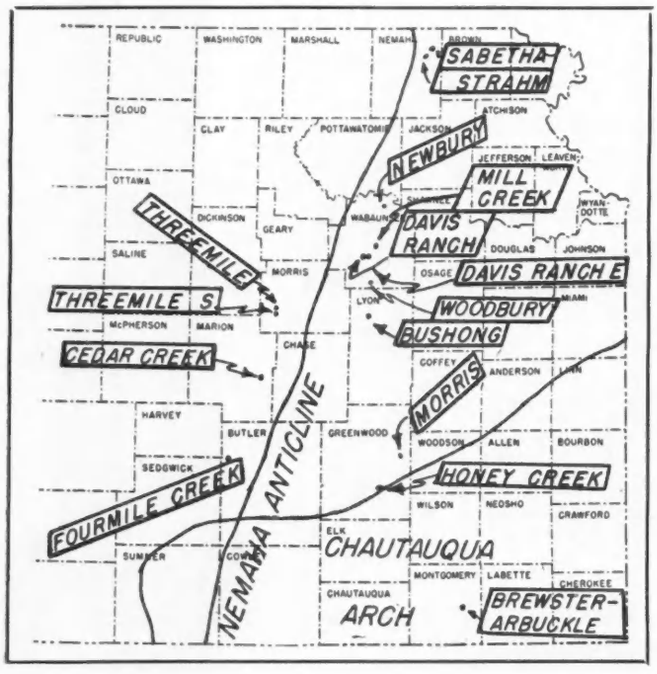

FIGURE 1. Pinpointed on this sketch map of eastern Kansas are the locations of significant recent oil discoveries in the pre-Pennsylvanian rocks.

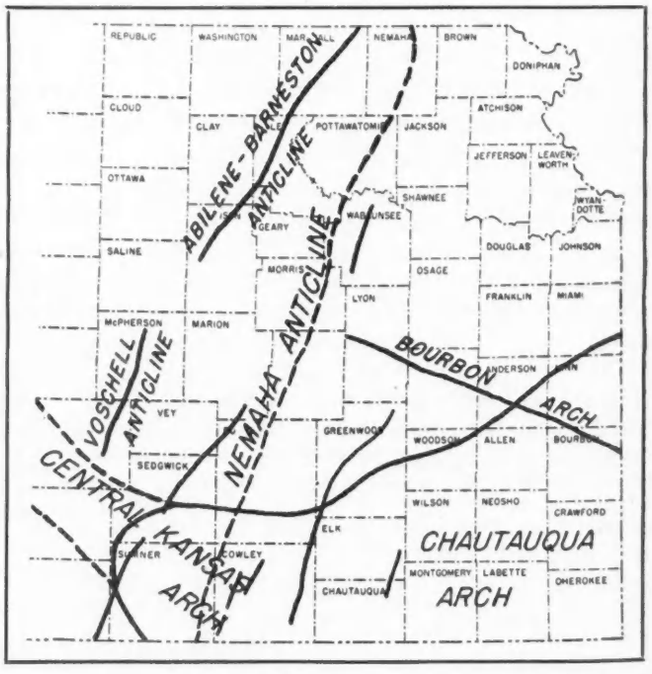

FIGURE 2. Sketch map showing direction of ancient structural grain established by Central Kansas arch, and locations of some post-Mississippian folds.

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wells are reported and 60,269 barrels of oil were produced from the pool last year.

A seemingly minor but none-the-less significant development in the past few months is the revival of oil production from the "Squirrel sand" in the old Dallas field in eastern Johnson County. A producing well was completed at about the close of last year in 13-13s-24e, and others are being drilled. The "Squirrel sand" lies at about 450 feet in the area. It is the reservoir rock that has yielded great amounts of oil in shoestring fields in Franklin and Miami counties where production now chiefly is by water-flood methods.

Thus not only has the trend of the Davis Ranch been marked with new fields but also discoveries elsewhere in eastern Kansas offer encouragement for well-planned wildcatting over a wide area.

Importance of the Structural Pattern

Too little cognizance has been given by some wildcatters to the general structural pattern and even to local structures in eastern Kansas. Wells are still put down in locations chosen because of hunches and doodle bug indications. By and large, structural patterns may mean disconformities and facies changes as well as anticlines and other folds. The many details of eastern Kansas geologic structure can not be elucidated here but in the subsequent part of this paper attention is called to some of the more important structural highlights (Figure 2).

The structural framework of Kansas has been discussed in many publications (see WORLD OIL, May 1950, page 70) and structural maps of several counties and smaller areas are available for comparison with geologic data that should be assembled before locations for test drilling are selected. "Thickness maps," showing thickness of selected parts of the stratigraphic section, afford a great deal of information that is highly important to oil geology. The list is too long to be included here. Only a few references are made.

It is believed that the structure that contains the Davis Ranch pool is a locally higher part of a longer fold that contains also the pools that have been found farther north in Wabaunsee County. However, there may be two or more folds *en echelon* lying approximately parallel with the axis of the Nemaha Anticline rather than a single simple fold, or there may be a fold several miles in length with others parallel to it.

It is timely to note structural conditions in front of the Nemaha Anticline farther south in Kansas that have been fairly well known for a long time. In Cowley County there are several *en echelon* folds detectable in outcropping rocks and more pronounced in buried formations (Bass, 1929). These exemplify some trends that may be designated Slick-Carson, Graham-Rainbow Bend, and Otto-Dexter. Seemingly, the latter is a part of the long Beaumont Anticline (Bass, 1936) which extends far to the north and east. Many miles farther east are the Longton and Fredonia anticlines. These structures are cited as examples of anticlinal folds in southeastern Kansas that in general are parallel to the Nemaha Uplift; all contain prolific oil pools. Farther north the general structure is known in somewhat less detail.

Abilene Arch Area Largely Untested

The area west of the Nemaha Anticline in northern Kansas should not be written off as territory without oil possibilities. Seemingly, the Abilene Arch or anticline, known northward from southwestern Dickinson County, is continuous with the Barneston Arch, whose axis enters Kansas near the northeast corner of Marshall County from Pawnee County, Nebraska. Farther south the prolific Voshell Anticline is part of the same structural trend. Several Viola limestone oil pools, the Elbing, Covert-Sellers, Florence-Urschell, the newly discovered Cedar Creek, and the Valley Center, are along the trend of the Bluff City Anticline that is known to extend from Oklahoma, crossing Sumner, Sedgwick, and Harvey counties, well into Marion County. It, too, is a long fold that approximately parallels the Nemaha Uplift. Oil pools along the Bluff City and Voshell trends are worthy of serious study in respect to possibilities west of the Nemaha structure farther north. In general the Abilene Arch country has been very inadequately tested. It and the west flank of the Nemaha Uplift offer interesting possibilities.

Effects of the Ancient Grain

Structures mentioned in the preceding paragraphs trend roughly from the southwest to the northeast in the direction established by the axis of the well-known Nemaha Anticline, known from the vicinity of Oklahoma City far into Nebraska. However, the more ancient grain of Kansas is nearly southeast-northwest and the real backbone of Kansas structure may be said to be the Central Kansas Arch which was defined by Dr. John L. Rich (1933). It is the combined Chautauqua Arch and the ancestral Barton Uplift, known now as the Ellis Arch. The Chautauqua Arch is the westward extension of the ancestral Ozark Uplift.

This ancient structural grain merits special attention. Several years ago Koester (1935) called attention to the preMississippian structures that constitute what he called the Wilson-Burns element, extending from the Burns Dome in Butler County to eastern Russell County, through the Elbing, Peabody, Ritz-Canton, and McPherson fields. Burns Dome is a high part of the Nemaha Anticline and oil pools farther northwest are on structures that also lie along lines of post-Mississippian folding parallel to the Nemaha fold. For example, the Elbing structure lies on the Bluff City Anticline and the McPherson field is on the Voshell Anticline. Disposition of Ordovician oil pools in Elk, Montgomery, and Labette counties suggest the southeastward extension of the Wilson-Burns element and that it is of consequence in regard to oil accumulation in southeast Kansas.

Farther north in eastern Kansas, one must proceed with more caution, but locations of several well known prominent structures suggest the influence of folding in accordance with the ancient grain as well as the later established Nemaha direction.

The sub-Pennsylvanian oil pools in eastern Kansas mentioned in this paper and those of earlier discovery largely lie below major disconformities such as bring Pennsylvanian beds or the Chattanooga shale in contact with eroded surfaces of the Viola or Arbuckle limestone. Space does not permit a discussion of the several disconformities in the eastern Kansas rock section but it should be kept in mind that these relationships are of equal importance in evaluating any eastern Kansas areas.

In conclusion, it may be said that random wildcatting, although at one time justifiable in eastern Kansas, is no longer to be encouraged; but there are still many areas in which, after thorough geologic investigations, it is believed that wildcats will be pool openers, just as they were last year.

BIBLIOGRAPHY

Bass, N. W., (1929) The geology of Cowley County, Kansas: Kansas Geol. Survey Bull. 12, pp. 1-203, Figs. 1-23, pls. 1-12.

———— — —, (1936) Origin of the shoestring sands of Greenwood and Butler Counties, Kansas: Kansas Geol. Survey Bull. 23, pp. 1-135, Figs. 1-10, pls. 1-21.

Jewett, J. M., (1949) Oil and Gas in Eastern Kansas: Kansas Geol. Survey Bull. 77, pp. 1-330, Figs. 1-53, pls. 1-4.

———— — —, (1950) Oil Prospects in Eastern Kansas: WORLD OIL, Vol. 130, No. 6, pp. 64-66, 68, 70, Figs. 1-7.

Koester, E. A., (1935) Geology of Central Kansas uplift: Amer. Assoc. Petroleum Geologists Bull. Vol. 19, No. 10, pp. 1405-1426, Figs. 1-5.

Rich, J. L., (1933) Distribution of oil pools in Kansas in relation to pre-Mississippian areal geology: Amer. Assoc. Petroleum Geologists, Bull., Vol. 17, No. 7, pp. 793-815, Figs. 1-2.

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Exploration

17.8 Percent Above 1950 Period

DURING the first six months of 1951, 4793 exploratory wells were completed, 854 more than in the corresponding period of 1950, an increase of 17.8 percent and an all-time record. Of current year explorations, 932 were rated commercially productive, 131 more than in the first six months of 1950, and 3861 were dry, an increase in failures of 723 over the first half of 1950.

Texas again led the nation's oil producing states in the number of wells completed with 2280, 510 more than in the same period of 1950. Kansas was second with 475, an increase of 143 exploratory tests. In Texas, District 7-B-North Central accounted for most tests drilled in any one Texas district with 568, up 185 over the corresponding period of 1950.

During June a record 1004 exploratory tests were completed in the nation, 102 more than in May, the previous record month. Of the month's wells, 200 were rated as commercial producers, approximately 20 percent of the total. Among the successful explorations, 103 were new oil field discoveries and 33 found new pays resulting in a total of 136 explorations discovering new oil sources. Twenty-one extension oil tests were successful. During the first six months of 1951, 463 tests opened up new oil fields, 180 found new oil pays, and 106 wells were successfully completed as oil extensions. Thirty-one new distillate fields and 13 new distillate pays were found, in addition to 79 gas fields and 22 gas pays.

In June, 9 new distillate pools were discovered, including 6 new fields and 3 new distillate pays. Gas discovery tests totaled 30, in addition to 3 successful extension attempts.

Of 804 unproductive tests during June, 780 were wildcats, 1 was a new pay exploration, and 23 were outposts.

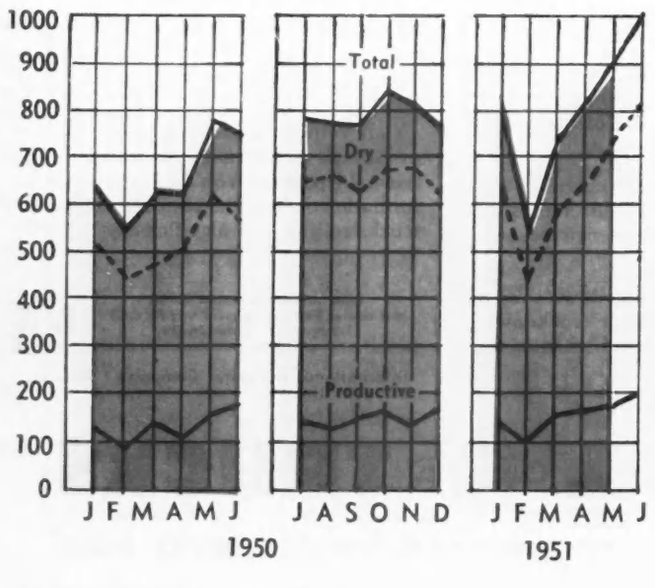
Accelerated drive for additional oil is evidenced in a month-to-month resume and a comparison of the six-month periods of 1951 and 1950 in the leading petroleum states.

Kansas ranked next to Texas in exploratory activity for the first six months of 1951 with a total of 475 exploratory tests, as compared with 332 for the same period of the previous year—an increase in 1951 of 30.1 percent. Of the 475 tests in 1951, 374 were failures as compared with 280 dry holes during the corresponding period of the previous year. Twenty-one new oil sources were dis-

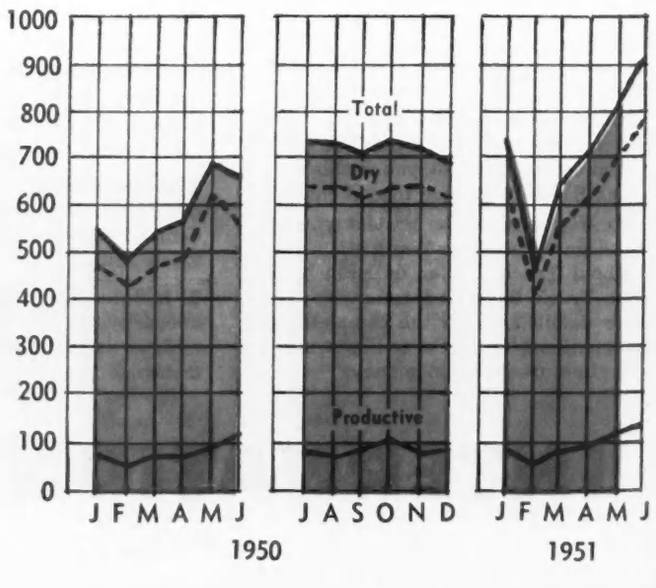
Summary of Results of Exploratory Drilling

ITEM	June, 1951	May, 1951	SIX MONTHS: January-June 1951	1950	Percent Diff.
Oil Discoveries	**136**	**116**	**643**	**523**	**+ 22.9**
New Fields	103	89	463	378	+ 22.5
New Pays	33	27	180	145	+ 24.1
Distillate Discoveries	**9**	**12**	**44**	**41**	**+ 7.3**
New Fields	6	8	31	35	— 11.4
New Pays	3	4	13	6	+116.7
Gas Discoveries	**30**	**14**	**101**	**72**	**+ 40.3**
New Fields	25	13	79	65	+ 21.5
New Pays	5	1	22	7	+214.3
Total Discoveries	**175**	**142**	**788**	**636**	**+ 23.9**
Extensions to Fields	**25**	**26**	**144**	**165**	**— 12.7**
Oil Fields	21	18	106	149	— 29.9
Distillate Fields	1	1	11	4	+175.0
Gas Fields	3	7	27	12	+125.0
Total Prod. Tests	**200**	**168**	**932**	**801**	**+ 16.4**
Dry Holes	**804**	**734**	**3,861**	**3,138**	**+ 23.0**
Wildcats	780	704	3,659	3,020	+ 21.2
New Pays	1	1	6	6	.....
Outposts	23	29	196	112	+ 75.0
Total Expl'tory Tests	**1,004**	**902**	**4,793**	**3,939**	**+ 21.7**
Percent Productive	19.9	18.6	19.4	20.3	.....
Percent Dry	80.1	81.4	80.6	79.7	.....

Total Exploratory Wells Completed



Strict Wildcats Completed



covered in Kansas during June, with 16 new oil fields and 5 new pay zones. One new gas field was found for a total productive number of tests in all categories of 22. Unproductive tests numbered 72, all wildcats, with exploratory tests totaling 94. By comparison, of 106 exploratory tests in May, 15 discovered new oil fields, 3 discovered new oil pays, and 2 discovered new gas fields for a total of 20 productive wells. Eighty-six wildcat tests were failures.

Oklahoma was the third ranking state from the standpoint of total exploratory tests completed during the first six months of 1951. Its 379 wells reflected a rise of 43 over the corresponding period of 1950 and led the fourth-ranking state, Illinois, by 50. Of 58 exploratory tests in Oklahoma during June, 41 wildcats were unproductive. Ten new oil sources were discovered, 8 of which were new oil fields and 2 new oil pays. Four extension tests for oil were successful. One new gas field was found, and two new distillate pays were discovered. Of 65 tests conducted in May, 56 wildcats were dry. However, six tests resulted in as many new oil fields and one discovered new oil pay. Also, two new gas fields were brought in.

Illinois tests during the first six months of 1951 declined 44 in comparison with the number drilled during the corresponding period of the previous year, from 373 to 329. Failures totaled 289. Of 12 productive explorations in June, 5 discovered new oil sources, 2 new fields and 3 new pays. Seven oil stepouts were successful. During the previous month, 76 exploratory tests resulted in 66 wildcat failures, and 10 producers. Half of the producers, all oil, resulted in new sources—4 new fields and 1 new pay. Five stepouts were rated as commercially productive.

California, with 280 exploratory tests during the first six months of 1951 as compared with 201 for the corresponding period a year before, reported 251 dry holes, 77 more than for the same period in 1950. Fifty-six tests in June resulted in 43 wildcat failures, 3 dry stepouts, and 10 productive wells. All of the latter discovered new oil sources, divided equally between new fields and new pays. In May 38 tests yielded 33 failures, of which 31 were wildcats and 2 were stepouts. Only five were productive, including 4 new oil sources, 3 new fields and 1 new pay, and a single gas extension.

Louisiana drilling activity during the first six months of 1951 increased 49 wells over the same period of the previous year when 143 tests were drilled. Of the 192 wells, 146 were unproductive. Six productive wells resulted from 36 attempts during the month of June. Of the 6, 3 found new oil sources, with a new field and 2 new pays, and 2 stepouts were successful. One new distillate field was discovered. In May 36 exploratory tests were drilled the results of which included 10 productive wells. All the failures were wildcats. Six new oil sources were found, 5 new fields and 1 new pay, and 1 extension was rated commercially productive. A distillate field was discovered, in addition to a new distillate pay and a successful distillate stepout.

Results of Exploratory Drilling in June and First 6 Months, 1951-1950, by Districts

State or District	MONTH OF JUNE, 1951													FIRST SIX MONTHS, 1951															
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests								Unproductive Tests				Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions			Total Productive					
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	6 Mo. 1951	6 Mo. 1950	Wildcats	New Pays	Outposts	Total Dry 6 Mo. 1951	Total Dry 6 Mo. 1950	6 Mo. 1951	6 Mo. 1950
Alabama							1			1	1			2				1			2			3	2	9			9	8	12	10
Arizona																										2			2		2	
Arkansas				1						1	11			12	3			6			2			11	7	38		4	42	42	53	49
California	5			5						10	43		3	56	13		1	10			4		1	29	27	226	2	23	251	174	280	201
Colorado	2		2							4	16		1	21	3		2			1				6	1	51		2	53	18	59	19
Florida																										1			1	6	1	6
Georgia																													4		4
Idaho																										1			1	3	1	3
Illinois	2			3			7			12	98			110	11			11			18			40	59	289			289	314	329	373
Indiana	8						2			10	30			40	18			3			2			23	21	156			156	225	179	246
Kansas	16		1	5						22	72			94	77		5	19						101	52	374			374	280	475	332
Kentucky	5			2						7	28			35	8			7			5			20	8	84			84	26	104	34
Louisiana	1	1		2			2			6	29	1		36	16	2	1	13	2	2	9	1		46	48	136	1	9	146	95	192	143
North Louisiana	1									1	20	1		22	9			2	1	2	4	1		19	14	85	1	2	88	42	107	56
South Louisiana		1		2			2			5	9			14	7	2	1	11	1		5			27	34	51		7	58	53	85	87
Maryland																													1		1
Michigan	1		1				1			3	38			41	5		3	1		1	1			11	22	149			149	122	160	144
Mississippi											12		1	13	4	2		2	1					9	13	56		4	60	77	69	90
Missouri																													2		2
Montana											3			3	1						2			3	1	13		2	15	26	18	27
Nebraska				1						1	4		1	6	4			1			1		4	10	4	24		3	27	20	37	24
Nevada																										2			2		2	
New Mexico	1		3							4	5			9	6		7	3			2		1	19	19	36		6	42	36	61	55
North Dakota																										1			1		1	
Ohio									1	1	3			4							1		4	5	2	13			13	6	18	8
Oklahoma	8		1	2	2		4			17	41			58	36		5	10	2	1	16	2	2	74	86	305			305	250	379	336
South Dakota																													2		2
Tennessee																													4		4
Texas	54	5	17	11	1	5	4	1	2	100	339		16	455	251	27	53	87	8	16	36	8	15	501	419	1641	3	135	1779	1351	2280	1770
Dist. 1 S. Central	2		1							3	18		2	23	12		3	1			1		1	18	10	93		11	104	97	122	107
Dist. 2 Middle Gulf	2	2	3	3		1		1	1	13	17			30	6	8	11	16		7	2	1	4	55	30	92		19	111	67	166	97
Dist. 3 Upper Gulf	3	1	2	2			1			9	34		1	44	11	7	10	17	2	2	2	1	2	54	45	137		4	141	106	195	151
Dist. 4 L. Gulf-S.W.	2	2	8	3	1	3	1		1	21	44		2	67	17	6	11	20	4	5	3	1	5	72	57	158	1	19	178	158	250	215
Dist. 5 E. Central											10		1	11	3	2		2			4			11	3	84		2	86	33	97	36
Dist. 6 Northeast											6			6	3	1		1			1	5		11	13	34		1	35	44	46	57
Dist. 7-B N. Cent.	23		2				1			26	85		3	114	91		11	7			4		2	115	94	442		11	453	289	568	383
Dist. 7-C W. Cent.	3									3	26		1	30	28	1	2	2	2		4			39	22	133		4	137	95	176	117
Dist. 8 West	5			2			1			8	33		1	42	28		3	10			8			49	75	178	2	12	192	144	241	219
Dist. 9 North	14		1	1		1				17	66		5	88	50	2	1	11		2	7		1	74	69	281		52	333	312	407	381
Dist. 10 Panhandle															2		1							3	1	9			9	6	12	7
Utah															1									1	1	11			11	5	12	6
Washington																													1		1
West Virginia																	2							2						2		
Wyoming				1						1	7		1	9	6			6		1	5			18	9	41		8	49	40	67	49
Total U. S.	103	6	25	33	3	5	21	1	3	200	780	1	23	1004	463	31	79	180	13	22	106	11	27	932	801	3659	6	196	3861	3138	4793	3939

U. S. Oil Distillate and Gas Discoveries and Extensions in May

ALABAMA—OIL FIELD EXTENSION

Choctaw County, Gilbertown field. J. F. Crow Well Servicing Company's A. L. Pippen 2, in 22-11n-5w. ½-mile north extension, pumped 100 barrels from Eutaw "A" sand, Cretaceous 3894-3912 feet, 20-gravity, completed 6-6-51, TD 3919.

ARKANSAS—NEW OIL PAY

Miller County, Fouke, Northeast field. Skelly Oil Company's Durham 1-B, C SE SE SW 21-16s-26w, pumped 160 barrels from 3959-71 feet, completed 6-1-51, TD 4610.

CALIFORNIA—NEW OIL FIELDS

Fresno County, "Riverdale, Northeast" field. Elmer Von Glahn's Coleman Commission 1, in 8-17s-20e, flowed 96 barrels from 6120-30 feet, 32.2-gravity, 10/64-inch, completed 5-23-51, TD 7603.

Kern County. Morton, Dolley, Campbell & Shell Oil Company's Kernco 43, in 34-29s-27e, flowed 45 barrels from Kernco sand, Miocene 4110-4240 feet, 16.8-gravity, completed 6-11-51, TD 4296.

San Luis Obispo County. R. B. Watkins' Luce 1, in 14-11n-28w, pumped 50 barrels from Lower Dibblee sand, Miocene 4561-4715 feet, 32-gravity, completed 6-16-51, TD 5378.

Santa Barbara County. Union Oil Company's Union Sugar 36, in 10-10n-36w, pumped 73 barrels from 3200-3410 feet, 12.5-gravity, completed 6-6-51, TD 4152.

Ventura County. Union's Rancho Ex-Mission 2, in 3-3n-23w, flowed 136 barrels from 3027-3110 feet, 29-gravity, completed 6-14-51, TD 3171.

CALIFORNIA—NEW OIL PAYS

Kern County, Edison, West field. California Exploration & MacMillan Petroleum Corporation's Porter 28-4, in 28-30s-29e, flowed 222 barrels from Chanac sand, Upper Miocene 3819-4020 feet, 22.5-gravity, 14/64-inch, completed 6-19-51, TD 4609.

Tejon Hills, Southwest field. Standard Oil Company's Tejon 3-68-21, in 21-11n-18w, flowed 150 barrels from 1056-68 feet, 29.1-gravity, 24/64-inch, completed 6-4-51, TD 1601.

Salt Creek field. Independent Exploration Company's Roco 14, in 18-29s-21e, flowed 165 barrels from Phacoides sand, Miocene 2388-2434 feet, 18-gravity, 15/64-inch, completed 6-11-51, TD 2434.

Los Angeles County, Castaic Junction field. Humble Oil & Refining Company's N. L. & F. 5, in 24-4n-17w, flowed 652 barrels from Mohnian sand, Miocene 10,215-530 feet, 19.7-gravity, ¼-inch, completed 6-6-51, TD 10,532.

Seal Beach field. J. I. M. Petroleum Company's Merritt-Taylor 1, in 3-5s-12w, pumped 302 barrels from 6967-8467 feet, 27-gravity, completed 5-20-51, TD 8467.

COLORADO—NEW OIL FIELDS

Logan County. British American Oil Producing Company's Arford 1, SW SW NE 28-9n-54w, pumped 20 barrels from "J" sand, Upper Cretaceous 5282-88 feet, ⅜-inch, completed 6-3-51, TD 5611.

Morgan County, Messex field. South Texas Development Company and Saltmount Oil Company's State 1, NE NE NW 1-5n-55w, pumped & flowed 250 barrels from Dakota "J" sand, Lower Cretaceous 5064-68 feet, completed 5-17-51, TD 5125.

COLORADO—NEW GAS FIELDS

Adams County, Badger Creek field. Orrin Tucker et al's Hough 1, NW NE NE 1-2s-57w, flowed 10 to 15 million from Dakota "D" sand, Lower Cretaceous 5214-22 feet, completed 5-1-51, TD 5564.

Rio Blanco County, Hell's Hole field. Roy Johnson & John Bunn's Government 1, C SE 12-2s-104w, flowed 11 million from Mesaverde sand, Upper Cretaceous 1050-2494 feet, completed 6-15-51, TD 2495.

ILLINOIS—NEW OIL FIELDS

Hamilton County, Walpole, South field. Dee Miller Drilling Company's H. E. Howard 1, SE SW NE 8-7s-6e, pumped 350 barrels from Aux Vases sand, Missis-

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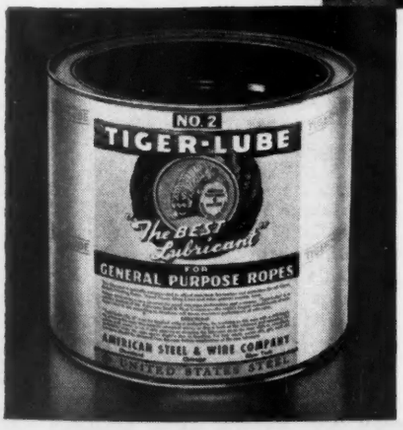

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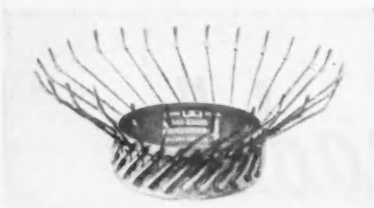

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❶ SCRATCH ON THE UP-STROKE won't "tear up" the hole while running in.

❷ RUGGEDLY CONSTRUCTED... Can "take it" on the casing rack and in the hole.

❸ LONG, STRONG, REVERSIBLE Multiple wire scratching fingers—5 inches long—are flexible, sturdy and scratch thoroughly.

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Strongest, Safest and Easiest to Install!

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sippian 3125-33 feet, completed 6-26-51, TD 3133.

Wabash County, Lexington, North field. Paul Rossi's E. Leitch 1, NW SE NW 23-1s-14w, pumped 46 barrels from Lower O'Hara lime, Mississippian 2931-35 feet, completed 6-19-51, TD 3004.

ILLINOIS—NEW OIL PAYS

White County, Epworth field. George & Wrather's Hanna 1, NE SE NE 32-5s-10e, pumped 49 barrels from Pennsylvania sand, Pennsylvanian 1847-58 feet, completed 6-26-51, TD 3067.

Gossett field. Howard Atha's M. Delap 1, SE SW NW 8-7s-8e, pumped 35 barrels from Cypress sand, Mississippian 2625-31 feet, completed 6-12-51, TD 2644.

Gossett field. Howard Atha's Rabe Shaw 1, NW SW NE 17-7s-8e, pumped 20 barrels from Aux Vases sand, Mississippian 2955-73 feet, completed 6-12-51, TD 2973.

ILLINOIS—OIL FIELD EXTENSIONS

Franklin County, Whittington field. J. H. Gilliam Drilling Company's Fitzgerrell Heirs 1, NW NW SE 29-5s-3e, ½-mile south extension, flowed 38 barrels from Cypress sand, Mississippian 2529-40 feet, completed 6-12-51, TD 2980.

Gallatin County, Inman West, Consolidated field. Farrell & Ripley's A. Maloney 1, SW SE NW 30-8s-10e, ¾-mile extension, pumped 5 barrels oil and 5 barrels water from McClosky lime, Mississippian 2832-34 feet, completed 6-5-51, TD 2837.

Richland County, Calhoun Consolidated field. John B. Murvin's F. Arterberry 1 (OWWO), N NE SE 8-2n-10e, 1-mile extension, pumped 8 barrels oil and 50 barrels water from McClosky lime, Mississippian 3196-99 feet, completed 6-12-51, TD 3245.

Olney Consolidated field. D. Baines' G. Stangle 1, SW SW SE 25-4n-10e, ¾-mile extension, pumped 15 barrels oil and 7 barrels water from McClosky lime, Mississippian 3152-60 feet, completed 6-12-51, TD 3162.

Wabash County, Lancaster, South field. Lambert & Rock Island Refining Company's A. L. Seibert 1, SE SE SE 21-1n-13w, ¾-mile southeast extension, pumped 40 barrels oil and 150 barrels water from Lower O'Hara lime, Mississippian 2670-76 feet, completed 6-12-51, TD 2712.

Wayne County, Clay City-Noble Consolidated field. W. H. Bears' G. Bradham 1, SE SE SW 1-1n-8e, ¾-mile extension, pumped 11 barrels oil and 6 barrels water from Lower O'Hara lime, Mississippian 3116-24 feet, completed 6-26-51, TD 3177.

Clay City Consolidated field. Mammoth Production Company's A. Davis 1, SE NE SW 2-1s-7e, ¾-mile extension, pumped 62 barrels oil and 8 barrels water from Lower O'Hara lime, Mississippian 3177-81 feet, completed 6-19-51, TD 3268.

INDIANA—NEW OIL FIELDS

Gibson County. Calvert Drilling, Incorporated & J. Lewis' Sanford Sanders 1, NW NW NW Mil Don 74-1s-10w, pumped 10 barrels oil and 75 barrels water from Hardinsburg sand, Mississippian 1330-38 feet, TD 1925.

Un-named field. Coy Oil Company's William Skiles A-1, NE SW NE 18-3s-13w, pumped 55 barrels from Cypress sand, Mississippian 2547-59 feet, TD 2559.

Un-named field. Rock Island Refining's & Burr Lambert's Edith Wallick 1 (OWWO), SW SE NW 20-2s-10w, pumped 25 barrels from Aux Vases sand, Mississippian 2038-47 feet, TD 2198.

Un-named field. Ryan & Sharp's Eliza E. Black 1, SW NW SW 4-3s-10w, pumped 70 barrels from Aux Vases lime, Mississippian 2047-53 feet, TD 2179.

Haubstadt field. A. J. Slagter Production Company's Victor Pohl 1, SE NE NW 31-3s-10w, pumped 9 barrels from Jackson sand, Upper Mississippian 1852-73 feet, TD 2317.

Knox County. Cal-Inda Oil Company's Elizabeth Myers 1, Mil Don 64-3n-8w, pumped 100 barrels from Aux Vases sand, Mississippian 1546-52 feet, TD 1552.

Pike County. Cline-Lambert & Olds Drilling Company's Charity Farm 1, NE SE NW 31-1s-7w, pumped 22 barrels from Cypress sand, Mississippian 1104-65 feet, TD 1388.

Posey County. Skiles Oil Corporation's Orwic Seiler Commission 1, NE NE SE 24-6s-12w, pumped 407 barrels from Biehl sand, Pennsylvanian 1601-12 feet, TD 2305.

INDIANA—OIL FIELD EXTENSIONS

Posey County, Caborn field. Ward W. Dayton's Lena Reuger 1, SE SW NE 36-6s-13w, ¾-mile southwest extension, pumped 47 barrels from Cypress sand, Mississippian 2368-77 feet, TD 2377.

Grafton field. George & Wrather's Aletha Spencer Vogel et al 1, SE SE NE 20-6s-14w, ½-mile northwest extension, pumped 28 barrels from Cypress sand, Mississippian 2503-18 feet, TD 2518.

KANSAS—NEW OIL FIELDS

Barton County, Eberhardt, West field. Alpine Oil & Refining Company's Petz 1, SE SW SW 14-19s-11w, pumped 49 barrels from Lansing-KC lime, Pennsylvanian 3136-41 feet, TD 3375.

Butler County. R. W. Holcomb's Price 1, SW SW SE 16-29s-6e, pumped 25 barrels from Lansing-KC lime, Pennsylvanian 2062-72 feet, TD 2072.

Chase County, Bazaar field. Morrison Drilling Company's Norton 2, SW SW SE 36-20s-8e, pumped 15 barrels oil and 60 barrels water from Lansing-KC lime, Pennsylvanian 1498-1827 feet, TD 1827.

Clay County, Wakefield field. K. I. Turner's Tannehill 1, C NW 15-9s-4e, pumped 6 barrels from Mississippi lime, Mississippian 1905-20 fet, TD 1922.

Finney County, Damme field. W. L. Hartman's Damme 1, SE SE SW 21-22s-33w, tested with bomb potential of 1795 barrels from Mississippi lime, Mississippian 3625-35 feet, 32-5 gravity, TD 4805.

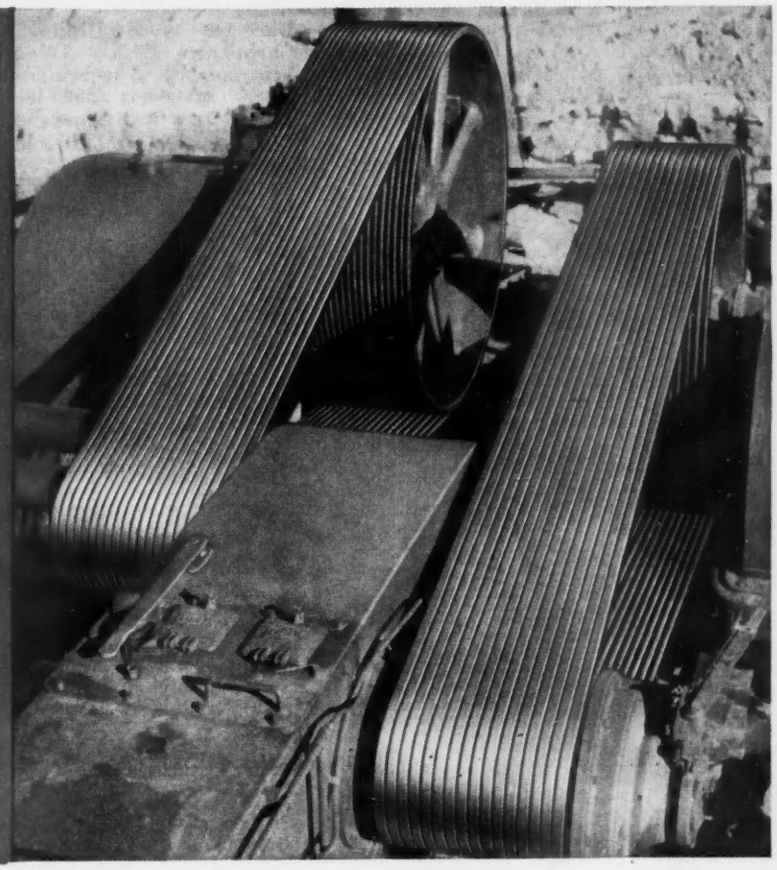
Kingman County, Dresden field. Lion Oil Company's McMichael 2, SE SE SW 13-27s-10w, pumped and flowed 432 barrels from Viola lime, Ordovician 4270-78 feet, TD 4470.

Rice County, Frederick field. Lewis Drilling Company's Schroeder 1 (OWWO), NE NE NE 10-18s-9w, pumped 212 barrels from Conglomerate 3241-67 feet, TD 3336.

Munyon, South field. Carl Lebsack's Schmidt 1, NE NE NW 3-19s-10w, pumped 209 barrels from Arbuckle lime, Ordovician 3307-20 feet, TD 3320.

Unnamed field. L. B. Jackson's Sims 1, NW SE SE 32-18s-6w, pumped 5 barrels from Lansing-KC lime, Pennsylvanian 2995-3015 feet, TD 3145.

Don't risk mud-pump failure!



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Dayton Thorobreds are made with cords of continuous filament, high-tenacity rayon, processed electronically on special machines. As a result, Thorobreds have greater shock strength, rugged durability, drive long after ordinary belts have worn out.

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WORLD'S LARGEST MANUFACTURER OF V-BELTS

SERVICE BY Continental

Rooks County, Locust Grove, Southeast field. Francis Oil & Gas Company's Anderson 1, SW SW SW 9-7s-19w, pumped 28 barrels from Arbuckle lime, Ordovician 3399-3409 feet, TD 3409.

Saline County. E. K. Carey's Oberg 1, NE NE NE 35-15s-4w, tested with bomb potential of 1186 barrels from Viola lime, Ordovicion 3412-16 feet, TD 3416.

Sedgwick County, Kuske, North field. Charles Carlock's Steig 1, SE SE NE 13-25s-1e, pumped 132 barrels from Burgess sand, Pennsylvanian 3016-17 feet, TD 3017.

Minneha, Northwest field. A. D. Allison's Stoltz 1, NE NE NE 10-27s-2e, pumped 112 barrels from Simpson sand, Ordovician 3300-09 feet, 44-gravity, TD 3319.

Stafford County, Byron, Southeast field. Duke & Wood Drilling Company's Christiansen 1, NW SW NW 10-21s-12w, pumped 42 barrels from Arbuckle lime, Ordovicion 3502-06 feet, TD 3506.

Eric field. Omega Oil Company's Eric Fischer 1 (OWWO), CE/2 NW NE 8-21s-13w, pumped 25 barrels from Lansing-KC lime, Pennsylvanian 3513-15 feet, TD 3629.

Sumner County, Zoglmann field. Petroleum Trading & Transport Company's Zoglmann 1, NE SE SW 8-31s-1w, pumped 86 barrels from Simpson sand, Ordovician 4034-38 feet, TD 4060.

KANSAS—NEW OIL PAYS

Barton County, Unruh field. Magnolia Petroleum Company's Radenberg 1 (OWWO), NW NE SE 24-20s-15w, pumped 22 barrels oil and 25 barrels water from Lansing-KC lime, Pennsylvanian 3442-52 feet, TD 3641.

Clay County, Wakefield field. K. I. Turner's Glace 2, NE SW NE 27-9s-4e, pumped 6 barrels from Mississippi lime, Mississippian 1792-97 feet, TD 1813.

Ellis County, Pleasant field. Sunray Oil Corporation Pfeifer A-3, SW SW SE 2-14s-20w, pumped 250 barrels from Lansing-KC lime, Pennsylvanian 3829-35 feet, TD 3867.

Meade County, Adams Ranch, East field. Columbian Fuel et al's Adams 1, SW NE NW 25-34s-30w, tested with bomb potential of 3000 barrels from Marmaton lime, Pennsylvanian 5346-50 feet, 41-gravity, TD 7327.

Sumner County, Metz field. Texas Pacific Coal & Oil Company's C. Metz 1, SE SE SW 6-32s-2e, pumped 132 barrels from Simpson dolomite, Ordovician 3735-41 feet, TD 3784.

KENTUCKY—NEW OIL FIELDS

Henderson County. Ellis-Morrison-Damron & George Hoffman's J. W. Galloway 1, SE SE SE 17-P-25, pumped 38 barrels from O'Hara lime, Mississippian 2367-71 feet, TD 2427.

Corydon, East field. George S. Engle's Charles Mattingly 1, in 2-O-22, pumped 100 barrels from Cypress sand, Mississippian 2263-74 feet, TD 2278.

Unnamed field. Dale Hopkins' Clara Phillips et al 1, NW SE NW 6-O-26, pumped 100 barrels from Cypress sand, Mississippian 1884-1904 feet, TD 1904.

Unnamed field. Tuley & Carter, Sam Walker & Jim G. Snyder et al's Otto Chase 1, N½ NW 19-Q-26, pumped 240 barrels from Lower McClosky lime, Mississippian 1986-92 feet, 37.6-gravity, TD 1992.

Webster County. W. F. Lacy & George & Wrather's L. B. Newton Heirs 1, SW SW SW 20-N-23, flowed 60 barrels from Hardinsburg sand, Mississippian 2010-20 feet, TD 2020.

KENTUCKY—NEW OIL PAYS

McLean County, Cleopatra field. G. L. Reasor's E. M. Pinkston 1, SE SW SW 8-N-27, pumped 56 barrels oil and 15 barrels water from Hardinsburg sand, Mississippian 1622-38 feet, TD 1640.

Unnamed field. G. L. Reasor's Stanley Pinkston 1, NE SW 7-N-27, pumped 112 barrels from Jackson sand, Mississippian 1792-1810 feet, TD 1810.

NORTH LOUISIANA—NEW OIL FIELD

Claiborne County, "Antioch" field. T. L. James & Company, Incorporated's F. B. King 1, in 29-22n-5w, pumped 21 barrels from Upper Pettit lime, Cretaceous 5210-20 feet, 31.3-gravity, completed 5-31-51, TD 11,045.

SOUTH LOUISIANA—NEW OIL PAYS

Assumption Parish, Napoleonville field. American Republics Corporation's Alex Simoneaux 1, in 43-12s-13w, flowed 103 barrels from 5436-46 feet, 33-gravity, 7/64-inch, completed 6-3-51, TD 5530.

Terrebonne Parish, Four Isle field. Superior Oil Company's LL&E State 2-Unit 7, in 15-21s-16e, flowed 235 barrels from 10,952-65 feet, 46-gravity, 8/64-inch, completed 6-2-51, TD 12,226.

SOUTH LOUISIANA—OIL FIELD EXTENSIONS

Plaquemines Parish, Quarantine Bay, East field. California Company's State Lease 1784-1, 1½ miles east extension, flowed 168 barrels from 7704-09 feet, 28.8-gravity, 8/64-inch, completed 6-11-51, TD 11,200.

South Pass Block 24 field. Shell Oil

Equipping your rigs with Foster Catheads really is a "natural"for assuring long life and low maintenance for your catheads.
Foster Catheads have earned their place on the finest drilling rigs in the world thru years of specialization in cathead manufacture. This specialization has meant the best in safety, speed, dependability and economy, whether it is on catheads for the shallowest or the deepest wells.

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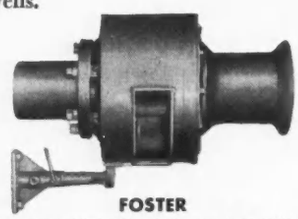

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P. O. BOX 1675 WICHITA FALLS, TEXAS

FACTORY REPRESENTATIVES

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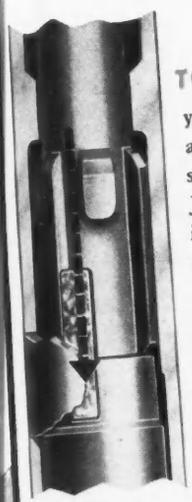
this is the tool that is revolutionizing drill string protection on today's wells!

The SHAFFER-WAGGENER BUMPER SAFETY JOINT

This is the *only* tool of its kind—the ONE tool that combines BOTH *Jarring* and *Releasing* action—each under the full control of the operator—for protecting modern drill strings, whether deep or shallow. And not only does it combine in *one* tool the protection usually requiring several tools, but it also provides unique operating advantages *found in no other single tool or combination of tools!*

Briefly, here's how it operates . . .

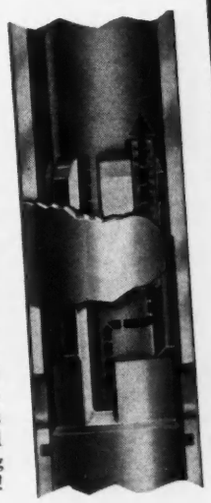


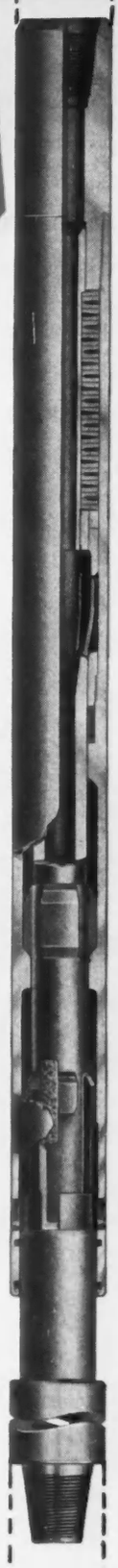
TO USE AS A BUMPER SUB

you need only slack the weight of approximately 2,000 feet of drill string upon the Bumper Safety Joint. This weight actuates a positive tripping mechanism which trips *automatically*, allowing the tool to strike a sharp downward blow. Raising the pipe then *automatically* resets the tool for another blow. Blows can be struck repeatedly and continuously by simply raising and lowering the drill string.

TO USE AS A SAFETY JOINT

for quick release from stuck drill collars in the event they cannot be loosened, you simply slack the tripping weight of the string on the Bumper Safety Joint and apply left torque as the string is slowly raised. The slight reverse torque rotates the drive keys into an unlocking slot similar to a "J" tool, so that, by simply continuing to raise the string, complete release from the lower portion of the drill string is effected. Further, the mandrel remaining in the hole is smaller in diameter than the drill collars, thus greatly facilitating fishing operations in tight holes!





TYPICAL SERVICE RECORDS

On job after job—from the shallowest wells right down to world's record depth—the Shaffer-Waggener Bumper Safety Joint is bringing new safety, new efficiency to modern drilling operations. Here are a few typical accomplishments . . .

- The Shaffer-Waggener Bumper Safety Joint has been used successfully in extreme directionally-drilled wells where a slant of 60° was maintained.
- The Shaffer-Waggener Bumper Safety Joint has been released and reconnected from a 30° angle at a depth of 8,500 ft.
- At 16,883 feet in the world's deepest well the Shaffer-Waggener Bumper Safety Joint proved invaluable in simplifying a recovery operation. A Bumper Safety Joint was being used between the drill collars and drill pipe when the string parted going into the hole, dropping over 2,400 feet of pipe and drill collars 5,000 feet to the bottom of the well at 16,883 feet. The top of the fish was gripped with a socket and the Bumper Safety Joint released, immediately recovering 2,100 feet of drill pipe. The upper part of the Bumper Safety Joint was then run back into the hole below a set of jars, reconnected to the lower half of the Bumper Safety Joint and—after jarring—the drill collars were completely recovered, leaving the hole clean.

Note: For maximum protection many operators are using the Bumper Safety Joint above wash-over strings to facilitate recovery should the string become stuck.

Whether used as a Bumper Sub or as a Safety Joint, the Shaffer-Waggener Bumper Safety Joint provides unique advantages found in no other tool—advantages too numerous to outline here but which are described in detail in a descriptive bulletin which will gladly be sent you on request. Send today for your free copy of this informative eight page bulletin!

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Company's State Lease 1388-1, 1½-mile northwest extension, flowed 208 barrels from 7460-66 feet, 22.7-gravity, 9/64-inch, completed 6-6-51, TD 11,860.

SOUTH LOUISIANA—NEW DISTILLATE FIELD

West Baton Rouge Parish. Sohio Petroleum Company's A. Wilbert & Sons 1-B, in 31-7s-11e, flowed 53 barrels and 2 million from 10,030-036 feet, 52.6-gravity, 10/64-inch, completed 5-18-51, TD 10,145.

MICHIGAN—NEW OIL FIELD

Montcalm County. Howard D. Atha's Carlson & Carlson 1, SE SE SW 26-11n-7w, Douglas Township, flowed 100 barrels from Traverse lime, Devonian 2993-3027 feet, 14/64-inch, TD 3492.

MICHIGAN—OIL FIELD EXTENSION

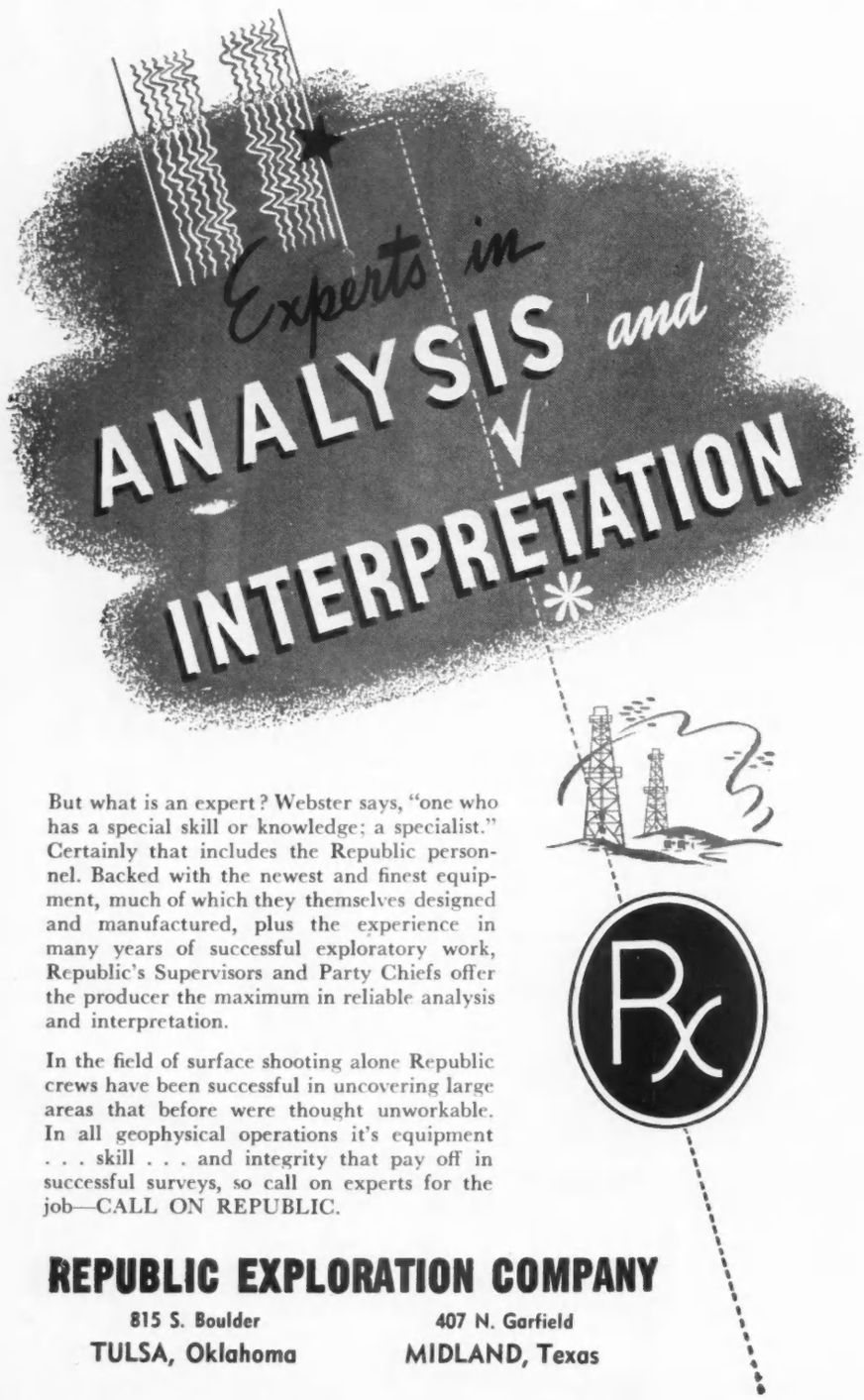
Ogemaw County, Rose City field. Brazos Oil & Gas Company's State-Foster KKK-1, N½ SE NW 25-24n-1e, 2-mile west extension, flowed 192 barrels from Richfield sand, Devonian 4155-4245 feet, 5/16-inch, TD 4245.

MICHIGAN—NEW GAS FIELD

Montcalm County. The Moco Company's Allen 1, SW NE SE 9-11n-8w, Pine Township, flowed 2 million from Stray sand, Mississippian 1247-53 feet, TD 1253.

NEBRASKA—NEW OIL PAY

Cheyenne County. Johnson field. Ohio Oil Company's Ed Miles 1, NW NE NW 2-14n-49w, pumped 136 barrels from 1st Dakota sand, Lower Cretaceous 4498-4500 feet, completed 6-10-51, TD 4690.



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NEW MEXICO—NEW OIL FIELD

Roosevelt County. Magnolia's J. B. Brown 1, 6-7s-34e, flowed 194 barrels from Permo-Pennsylvanian sand, Pennsylvanian 8131-43 feet, 47.6-gravity, ¼-inch, completed 6-2-51, TD 9067.

NEW MEXICO—NEW GAS FIELDS

San Juan County, Blanco, West field. Delhi Oil Corporation's H. B. Sellers 1, SW NE NE 30-30n-10w, flowed 0.6-million from Point Lookout sand, Upper Cretaceous 4870-5066 feet, TD 5066.

Gallegos Canyon field. J. D. Hancock's Edgar 2, SW NE SW 12-27n-12w, flowed 2.6-million from Pictured Cliffs sand, upper Cretaceous 1691-1791 feet, TD 1791.

OKLAHOMA—NEW OIL FIELDS

Beckham County, Mayfield, Northeast field. Carter Oil Company's Cora Garret 1, SE SE SE 32-11n-25w, flowed 180 barrels from Hoxbar conglomerate, Pennsylvanian 10,271-295 feet, 40.2-gravity, 3/16-inch, TD 11,100.

Comanche County. Texola Drilling Company's J. L. Brown 1 (OWWO), SE SW NW 24-4n-11w, flowed 15 barrels from Tulip Creek sand, Ordovician 2434-54 feet, 30-gravity, TD 3002.

Creek County, Poor Farm, Southeast field. Jones & Shelburne's Bishop 1, SW SE NW 12-15n-8e, pumped 42 barels oil and 18 barrels water from 2nd Wilcox sand, Ordovician 3693-3708 feet, 39-gravity, TD 3710.

Garfield County, Garber, Southeast field. H. C. Bundys et al's J. N. Hodges 1, SW SW NW 3-21n-3w, flowed 150 barrels from Garber (Crews) sand, Pennsylvanian 2164-82 feet, 43-gravity, open, TD 2221.

Grant County. Sinclair Oil & Gas Company's Hyder Mulkey 1, NW NW NE 7-25n-4w, flowed 412 barrels from 2nd Wilcox sand, Ordovician 5815-20 feet. 45.1-gravity, 13/64-inch, TD 5820.

Lincoln County. A. R. McElreath et al's Hugh Robertson Estate 1, SE NW SW 3-14n-6e, flowed 1200 barrels from 2nd Wilcox sand, Ordovician 3845-3930 feet, 45-gravity, ½-inch, TD 3934.

McClain County, Johnsonville, West field. Atlantic Refining Company's P. A. Newbern 1, SE SE NW 22-5n-2e, flowed 86 barrels from Basal Pennsylvania lime, Pennsylvanian 4290-4302 feet, 42-gravity, 14/63-inch, TD 5790.

Stephens County. Van Grisso & Kerr McGee & Glenn S. Norville's Elenora Killingsworth 2, SW SW NE 13-2s-5w, flowed 122 barrels from Lower Tussy sand, Pennsylvanian 2050-98 feet, 37-gravity, open, TD 2751.

OKLAHOMA—NEW OIL PAYS

Lincoln County, Davenport, South field. Keystone Oil Company's Cox 1, SW SW SE 22-14n-5e, flowed 67 barrels from Cleveland sand, Pennsylvanian 2745-2755 feet, 24/64-inch, TD 2755.

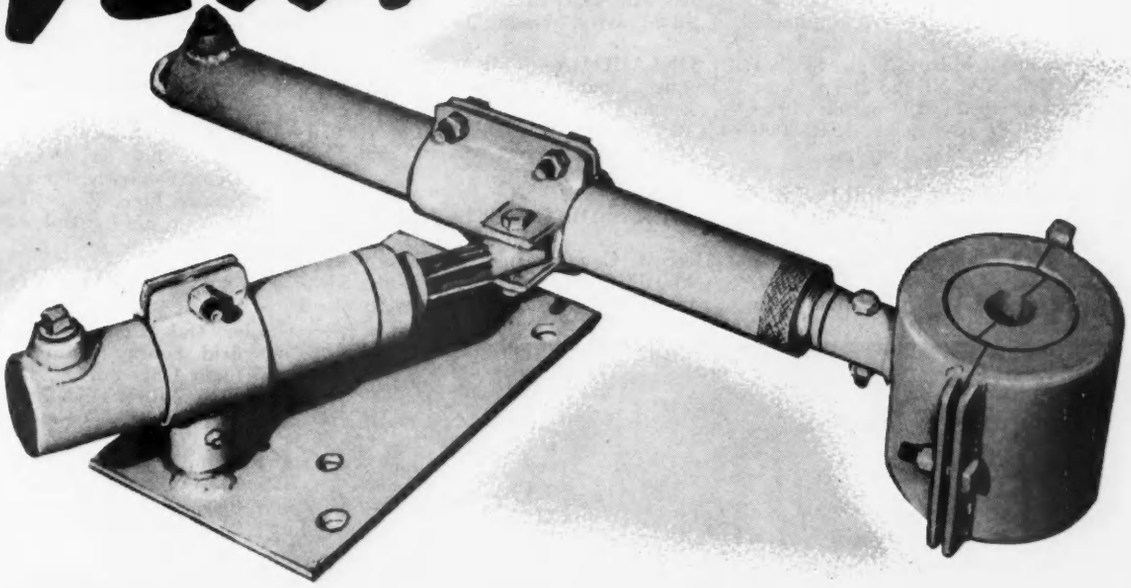
Unnamed field. McElreath, Biffle & Harvey's Roberson Estate 2, NW NW SW 3-14n-6e, pumped 377 barrels from Hunton lime, Devonian-Silurian 3982-4012 feet, ¼-inch, TD 4220.

OKLAHOMA—OIL FIELD EXTENSIONS

Marshall County, Aylesworth field. Hubert E. Bale's Little 1, SW SE SE 4-6s-6e, pumped 55 barrels from Bromide sand, Ordovician 3210-3390 feet, 38-gravity, TD 3390.

Oklahoma County, Peavine field. Harper-Turner Oil Company's Santee 1, NW NW NE 11-14n-2w, ½-mile east ex-

NEW!



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tension, flowed 113 barrels from 2nd Wilcox sand, Ordovician 6213-18 feet, 38-gravity, 1/8-inch, TD 6221.

Payne County, Markham, West field. H. Waggoner's Scott 1, SW SW SE 8-18n-6e, ½-mile west extension, flowed 35 barrels from Prue sand, Pennsylvanian 2891-2901 feet, 39.7-gravity, 3/16-inch, TD 3133.

Stephens County, Milroy field. Skelly's Jones 1, NE SW NE 23-2s-4w, west extension, pumped 219 barrels from Tussy sand, Pennsylvanian 1940-2000 fet, 34.1-gravity, TD 6196.

OKLAHOMA—NEW DISTILLATE PAYS

Cleveland County, Moore, West field. Mid-Continent Oil Company's Edgar Harris 3 (OWDD), C NE SW 29-10n-3w, flowed 92 barrels and 3-million from Joins sand, Ordovician 9452-69 feet, 51.3-gravity, 20/64-nch, TD 9703.

Grady County, Bradley, Northeast field. Gulf Oil Corporation's Mainka Ring Unit 1, C SE NE 12-5n-5w, flowed 217 barrels and 1-million from Chimney Hill lime, Silurian 12,120-240 feet, 48.6-gravity, ¼-inch, TD 13,651.

OKLAHOMA—NEW GAS FIELD

Hughes County. Davidor & Davidor's Emma Cordell 1, NW SW SW 2-8n-10e, flowed 20.1-million from 1st Gilcrease sand, Pennsylvanian 2590-2630 feet, TD 3204.

TEXAS DISTRICT 1—NEW OIL FIELDS

Atascosa County. Imogene, South field. Martin, Shelly and Thomas' Katie Richter 1, Williams Echols Survey, pumped 82 barrels from Carrizo sand, Eocene 1763-73 feet, 22.9-gravity, completed 6-7-51, TD 1903.

Unnamed field. C. C. Dauchy & Miller Roytalty Company's Jane Burns 1, Francis Cerelling Survey, pumped 34 barrels from Navarro sand, Upper Cretaceous 3550-67 feet, 40-gravity, completed 6-11-51, TD 3567.

TEXAS DISTRICT 1—NEW GAS FIELD

Val Verde County. R. J. Caraway's Mrs. Guida Rose 1, NE¼ of Section 2, GC&SF Survey, flowed 35-million from Strawn lime, Pennsylvanian 10,050-100 feet, open, completed 5-12-51, TD 11,580.

TEXAS DISTRICT 2—NEW OIL FIELDS

Live Oak County, "Goebel, Northeast" field. Sunray's Otto W. Zamzow 1, Refugio CSL Survey, flowed 115 barrels from Wilcox sand, Eocene 7248-50 feet, 29.2-gravity, 7/64-inch, completed 5-29-51, TD 7252.

Refugio County. P. R. Rutherford et al's P. H. Fagan 1-J, James Fagan Survey, flowed 110 barrels from 4708-4712 feet, 24-gravity, 7/64-inch, completed 6-6-51, TD 4715.

TEXAS DISTRICT 2—NEW OIL PAYS

Goliad County, Berclair field. Scurlock Oil Company's Methodist Episcopal Church (OWWO) 1, W. P. Miller Survey, pumped 30 barrels from Frio sand, Oligocene 2239-42 feet, 22.5-gravity, TD 3244.

Jackson County, Swan Lake field. Southern Minerals Corporation's G. T. Brooking 16, Josiah H. Bell Survey, flowed 145 barrels from Frio sand, Oligocene 7726-29 feet, 43.3-gravity, 7/64-inch, completed 6-12-51, TD 8699.

Refugio County, Refugio field. Sam E. Wilson, Jr.'s, Rogers Estate 1, James Powers Survey, flowed 91 barrels from 4750-55 feet, 36.2-gravity, 7/32-inch, completed 6-11-51, TD 6503.

TEXAS DISTRICT 2—NEW DISTILLATE FIELDS

Dewitt County. George W. Graham et al's O. L. Caruthers 1, H. M. Salley Survey, flowed 56 barrels and 2.2-million from Mackhank sand, Eocene 7452-58 feet, 54-gravity, 10/64-inch, completed 5-18-51, TD 7562.

"Henze" field. Rowan & Hope Oil Company's Mary Henze 1, Jose Santos Survey, flowed distillate and 12-million from Slick sand, Eocene 7332-70 feet, 56-gravity, open, completed 6-15-51, TD7614.

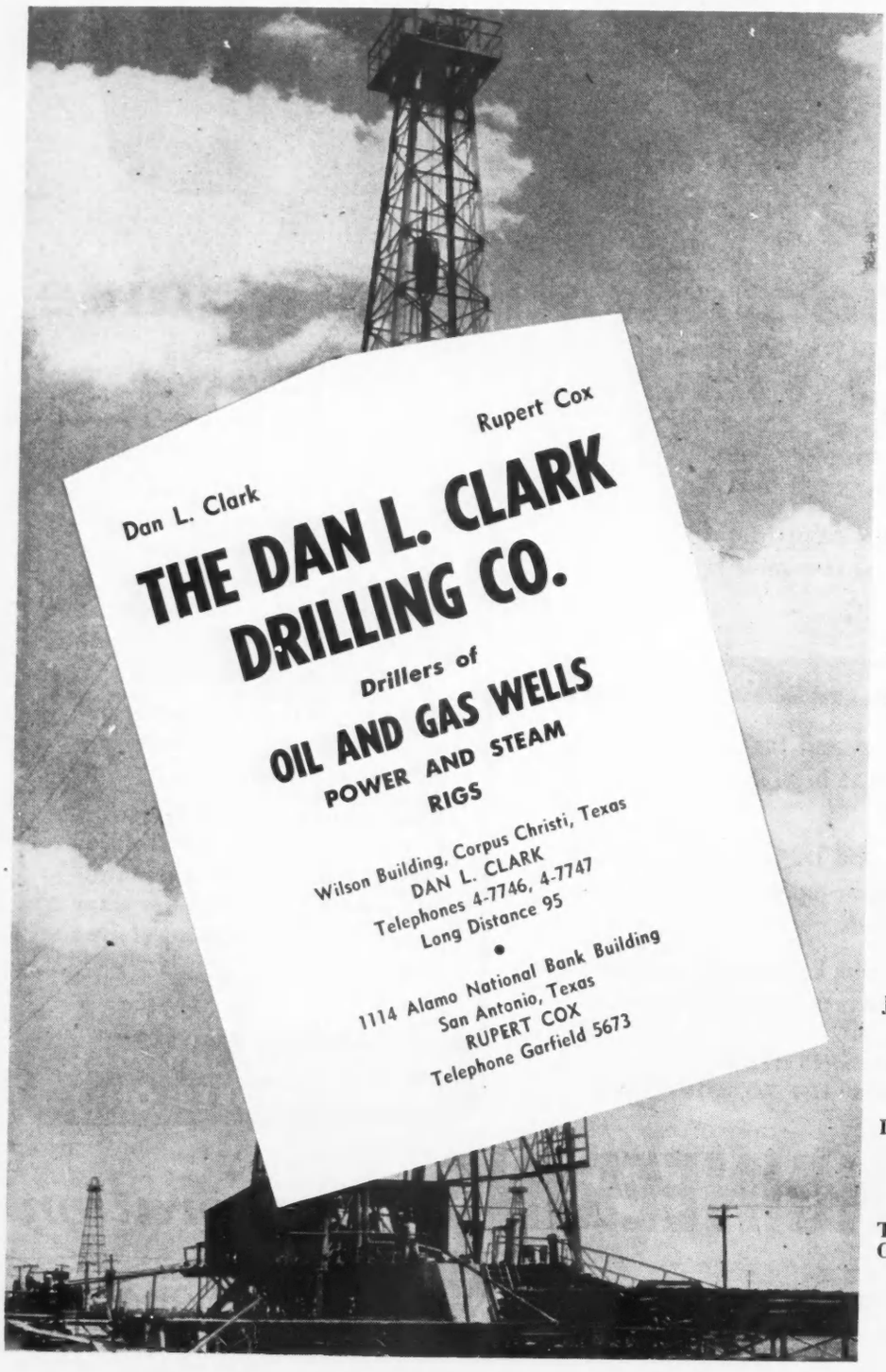
TEXAS DISTRICT 2—NEW GAS FIELDS

Jackson County. Curtis Singleton Drilling Company's R. L. Hollingsworth 2, Eli Mercer Survey, flowed 8-million from 3830-36 feet, and 18-million from 4005-09 feet, open, completed 6-1-51, TD 4160.

Live Oak County. Howeth & Mason's Sanger Estate 1, GC&SF Survey, shut in with no gauge at 2639-51 feet, completed 5-22-51, TD 2716.

TEXAS DISTRICT 2—NEW GAS PAY

Goliad County, Terrell Point field. Gasoline Production Corporation's Stella E. Johnson 3, Martin Lawler Survey, flowed 126-million from Frio sand, Oligocene 4645-49 feet, completed 6-20-51, TD 4745.



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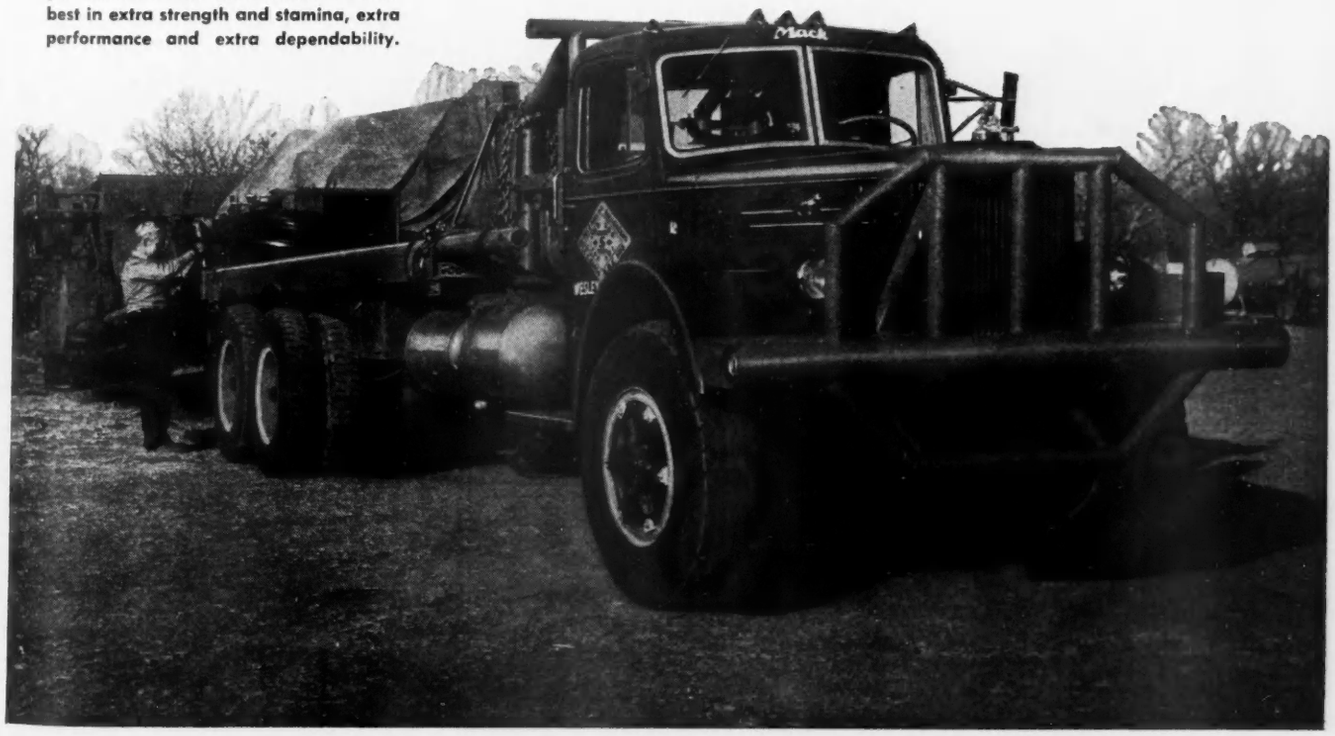

TEXAS DISTRICT 3—NEW OIL FIELDS

Jasper County. American Republics & Houston Oil Company's Salvador Castillo Fee 2, Salvador Castillo League, flowed 52 barrels from 6987-89 feet, 41.8-gravity, 7/64-inch, completed 6-7-51, TD 8125.

Newton County. Houston Oil Company & American Republic's Earl C. Hankamer et al B-2, HT&B RR Survey, flowed 183 barrels from 7225-26 feet, 37.7-gravity, 9/64-inch, completed 6-18-51, TD 7343.

Washington County. Sinclair's Bess Henry 1, William Gates Survey, flowed 243 barrels from Wilcox sand, Eocene 9214-16 feet, 43.8-gravity, ¼-inch, completed 6-14-51, TD 11,495.

TEXAS DISTRICT 3—NEW OIL PAYS

Fayette County, Muldoon, Southwest field. Deep Rock Oil Company's Standard Trust 1, James Parrott Survey, pumped 71 barrels from Wilcox sand, Eocene 2226-42 feet, 21-gravity, completed 6-30-51, TD 2274.

Fort Bend County, Blue Ridge field. Petroleum Management Company's Robinson-Bashara 2, Hicks Schropshire Survey, flowed 120 barrels from 4146-50 feet, 30.5-gravity, 8/64-inch, completed 6-14-51, TD 4303.

TEXAS DISTRICT 3—OIL FIELD EXTENSION

Austin County, New Ulm field. Oil Drilling, Incorporated's C. J. Marik 1, Randolph Von Roeder Survey, 1¾ miles southeast extension, flowed 159 barrels from 9197-9211 feet, 35-gravity, 10/64-inch, completed 6-11-51, TD 10,351.

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TEXAS DISTRICT 3—NEW GAS FIELDS

Matagorda County. Brazos Oil & Gas Company's State of Texas 2-M-A 35916, Matagorda Bay Tract 179, no gauge from 5157-69 feet, completed 6-9-51, TD 5750.

Orange County. Union Producing's H. L. Brown Fee 2, I&GN Survey, flowed 4-million from 7997-8001 feet, completed 6-13-51, TD 8100.

TEXAS DISTRICT 4—NEW OIL FIELDS

Jim Hogg County. Sun Oil Company's A. C. Jones 29, Agua Nueva de Arriba Grant, flowed 127 barrels from 4943-47 feet, 43.7-gravity, 5/32-inch, completed 6-25-51, TD 4997.

San Patricio County, "Nueces Bay, West" field. Humble's Fanny D. Wilson 1, J. F. Smith Survey, flowed 188 barrels from 8405-20 feet, 37-gravity, 9/64-inch, completed 6-2-51, TD 8700.

TEXAS DISTRICT 4—NEW OIL PAYS

San Patricio County, Portilla field. Superior's Minnie S. Welder 29, Section 19, Welder Ranch Subdivision, no gauge from 7453-59 feet, and 160 barrels from 8642-68 feet, 33-gravity, 8/64-inch, completed 5-30-51, TD 9150.

Sinton, West field. Wymore Oil Company's Lillie Caddell 1 (OWDD), John Pollan League, flowed 63 barrels from 3378-81 feet, 22-gravity, ¼-inch, completed 6-14-51, TD 4475.

Starr County, Marks field. The Texas Company's W. D. Hornaday 4, "El Javali" Juan Flores Grant, flowed 165 barrels from 2064-71 feet, 34.6-gravity, 20/64-inch, completed 6-10-51, TD 2071.

TEXAS DISTRICT 4—OIL FIELD EXTENSIONS

Duval County, Poquita Creek field. Ralph Lowe's D. C. Chapa 1, C. M. Chapa Survey, ¾-mile southwest extension, pumped 29 barrels from 2498-2514 feet, 25.2-gravity, completed 6-20-51, TD 2524.

TEXAS DISTRICT 4—NEW DISTILLATE FIELD

Nueces County. Sunray's State Tract 352-1, Red Fish Bay, no gauge from 7220-42 feet, completed 6-15-51.

Starr County. C. G. Glasscock & Selby Walker Corporation's Yturria Land & Livestock Company 1, Porcion 43, flowed distillate and 14.5-million from 5895-5905 feet, open, completed 5-3-51, TD 9505.

TEXAS DISTRICT 4—NEW DISTILLATE PAY

Starr County, Unnamed field. Chicago Corporation's State-Slick A-2, J. C. McCarty Survey, flowed distillate and 14.5-million from 4342-51 feet, 61.3-gravity, open, completed 6-19-51, TD 5911.

TEXAS DISTRICT 4—NEW GAS FIELDS

Aransas County. Western Natural Gas Company's St. Charles Ranch Co. 13, I. Dowess Survey, flowed 86-million from 10,320-360 feet, open, completed 6-26-51, TD 11,275.

Hidalgo County. The Texas Company's Pate Gas Unit 1, Antonia Gutierrez Survey, flowed 7-million from 6253-63 feet, open, completed 6-20-51, TD 8000.

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Jim Wells County. W. Earl Rowe et al's R. V. Embleton 1, Los Presenos de Arriba Grant, Block 10 of Al Smith Farm Subdivision, flowed 10-million from 3402-08 feet, open, completed 6-13-51, TD 3520.

Unnamed field. Arnold O. Morgan's Charles Hoelscher 1, Los Presenos de Abajo Grant, no gauge from 3630-34 feet, completed 6-1-51, TD 3690.

Nueces County. Forest Oil Corporation's May Dunn Wagner 1, Lot 17, Section 40, Flour Bluff & Encinal Farm & Garden Tracts, flowed 17-million from 6629-35 feet, completed 5-17-51, TD 7005.

San Patricio County, "Patrick" field. La Gloria Corporation's Mary Lou Patrick 1, Section 18, Lot 42, 3rd Addition to Taft Farm Lands, flowed 16-million from 5916-27 feet, open, completed 5-29-51, TD 6513.

Starr County, "El Javali" field. Chicago Corporation's Bessie H. Cocke 1, El Javali Grant, flowed 8-million from Loma Novia sand, Eocene 2223-27 feet, open, completed 6-6-51, TD 2510.

TEXAS DISTRICT 4—NEW GAS PAYS

Duval County, Hagist Ranch field. The Texas Company's Hagist Ranch, Incorporated, NCT-1, Z. Benson Survey, flowed 0.5-milion from Frio sand, Oligocene 834-46 feet, completed 4-8-51, TD 7456.

San Patricio County, Lou Ella field. A. W. Gregg's City of Corpus 10, Casa Blanca & N. P. & J. H. Delgado Survey, no gauge from Stillwell sand, Oligocene 5102-12 feet, completed 6-7-51, TD 5127.

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TEXAS DISTRICT 7-C—NEW OIL FIELDS

Coke County. A. G. Hill's Ralph Harris Estate 8, Section 10, W. Scott Survey, flowed 104 barrels from Caddo lime, Pennsylvanian 6771-75 feet, 41.3-gravity, 8/64-inch, completed 6-20-51, TD 7270.

Reagan County. Paul F. Barnhart's G. S. Wimberly 1-15, Section 15, Block C, L&SV Survey, flowed 176 barrels from Spraberry sand, Permian 6795-6900 feet, 36.8-gravity, 20/64-inch completed 6-21-51, TD 6900.

Runnels County. Blackwell Oil & Gas Company's Gerhart 1, J. H. San Miguel Survey, pumped 39 barrels from Upper Gardner sand, Pennsylvanian 3916-28 feet, 40-gravity, completed 6-20-51, TD 3928.

TEXAS DISTRICT 8—NEW OIL FIELDS

Borden County. Stanolind Oil & Gas Company's R. C. Miller 1, Section 3, Block 30, T-5-N, T&P Survey, pumped 157 barrels from Spraberry sand, Permian 5265-5400 feet, 38-gravity, completed 6-23-51, TD 8645.

Dawson County. James H. Snowden et al's Carrie S. Dean 1-32, Section 32, Block 1, J. Poitevent Survey, pumped 44 barrels from Spraberry sand, Permian 7276-86 feet, 39.6-gravity, completed 6-6-51, TD 8700.

Glasscock County. El Capitan Oil Company's Whitehouse 1, Section 47, Block 37, T-4-S, T&P Survey, flowed 322 barrels from Spraberry sand, Permian 6936-7028 feet, 36.8-gravity, ½-inch, completed 6-10-51, TD 7028.

Midland County. Moore Exploration Company's A. R. Bauman 1, Section 14, Block 38, T-2-S, T&P Survey, flowed 226 barrels from Lower Pennsylvania sand, Pennsylvanian 11,273-81 feet, 47.5-gravity, 8/64-inch, completed 6-17-51, TD 11,293.

Pecos County. Wood River Oil & Refining Company, Incorporated's J. Williams 2-A, Section 4, Block 3, H&TC Survey, flowed 126 barrels from Clear Fork sand, Permian 3850-99 feet, 37.6-gravity, 15/64-inch, completed 6-1-51, TD 5265.

TEXAS DISTRICT 8—NEW OIL PAYS

Martin County, Glass field. Gulf's G. W. Blass B-2-E, Section 12, Block 39, T-1-N, T&P Survey, flowed 552 barrels from Pennsylvania sand, Pennsylvanian 10,450-12,193 feet, 49.2-gravity, ½-inch, completed 6-2-51, TD 12,661.

Scurry County, Hermleigh field. R. Olsen Oil Company's J. W. Templeton 1, Section 52, Block 3, H&TC Survey, flowed 219 barrels from Ellenburger lime, Ordovician 7392-7436 feet, 42.2-gravity, open, completed 6-19-51, TD 7439.

TEXAS DISTRICT 8—OIL FIELD EXTENSION

Pecos County, Fort Stockton field. W. K. Garnett's Williams-Eaton 1, Section 1, Block 166, Reuben Phares Survey, ½-mile south extension, pumped 20 barrels from Yates sand, Permian 2814-34 feet, 34-gravity, completed 5-30-51, TD 2834.

WYOMING—NEW OIL PAY

Johnson County, Sussex "A" field. Continental Oil Company's Unit 59, SW NW SE 17-42n-78w, flowed 1488 barrels from Tensleep sand, Pennsylvanian 9111-9299 feet, 30.1-gravity, completed 6-4-51, TD 9299.

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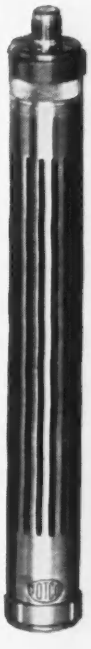

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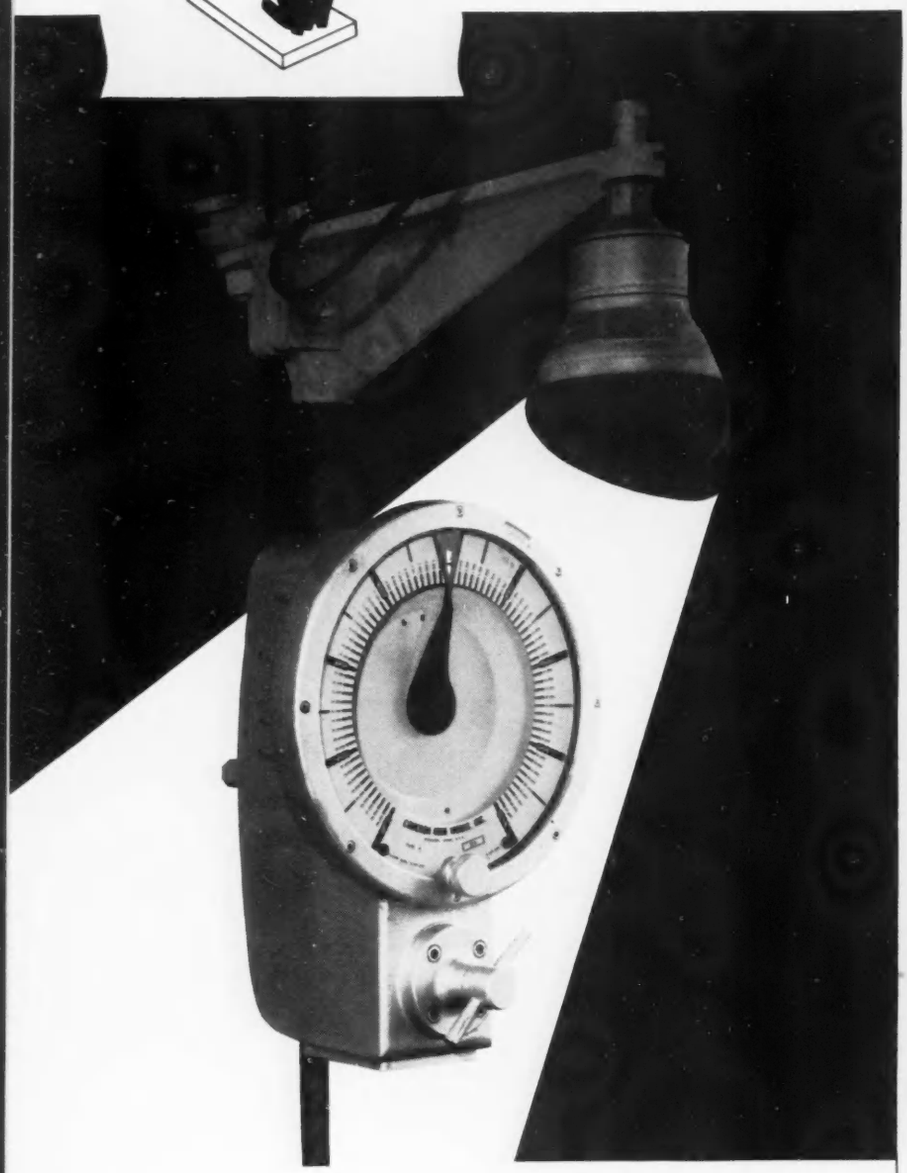

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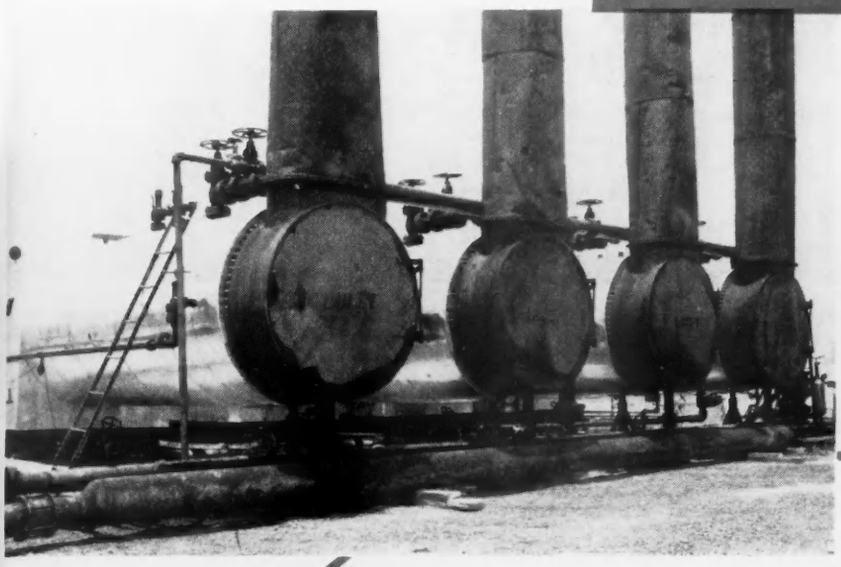


FIGURE 1. General view of the Falcon Seaboard Drilling Company boiler preheater unit. The outer shell, which is constructed of 13⅜-inch casing, contains 15 runs of two-inch horizontal tubing coils. An 8⅝-inch welded swedge is formed at the steam feed end while the exhaust end is reduced to four inches.

Shop-Made Preheater Cuts Fuel Costs, Aids Boiler Efficiency

By C. W. ALCORN

Vice President, Falcon Seaboard Drilling Company, Houston

THE over-all efficiency of a battery of conventional fire tube boilers can be increased and the fuel consumption materially reduced through the installation of an inexpensive, shop-fabricated preheater unit. Through the application of the unit illustrated in Figure 1, Falcon Seaboard Drilling Company has cut fuel costs as much as 25 percent, meanwhile amortizing the unit cost in a very short period.

Function of Preheater

The preheater does not require any elaborate equipment and can be fabricated in the field. Basically, the unit consists of a 40-foot section of 16- or 18-inch casing filled with 450 to 600-feet of two-inch tubing coils. Boiler water is heated to approximately 170° F. in a conventional preheater, picked up by the boiler feed pump, injected through the final preheating stage, and then directly into the boiler. In this manner, it is possible to preheat the water, prior to its introduction into the boiler, to a point wherein it would be impossible to move the fluid with the boiler feed pump. Since the secondary preheating unit is not equipped with a thermometer, the final water temperature is unknown; however, under conditions of pressure from the boiler feed pump plus high temperature exhaust steam, it is likely that the water approaches a condition above 212 degrees prior to entering the boiler. Herein lies the secret of this unique preheater system—that water may be heated to a very high temperature prior to introduction into the boiler.

Exhaust steam from the 14x14 drawworks engine, three 20-inch mud pumps, and the boiler feed pumps is introduced into the preheater log. Hence, no fuel is utilized in the generation of special steam for this preheater unit.

An example of the fuel savings available through the utilization of this unit is well illustrated in a case where, while drilling at 9600 feet, the fuel consumption was reduced from 1 million to 750,000 cubic feet per day, or a reduction of 25 percent. At the time, the cost of fuel gas in the vicinity was 12 cents per 1000 cubic feet. Hence, the boiler operating expense was reduced from $120 to $90 per day or a savings of $30 per day. Actual construction of the unit in-

A SIMPLE, inexpensive preheating unit, which is capable of reducing fuel costs as much as 25 percent, is described. In use on the Falcon Seaboard Drilling Company rigs, this preheater can be completely amortized during the process of drilling just one well. Installation of the equipment will offer advantages beyond the scope of increased boiler efficiency such as reduced feed pump maintenance costs and smoother pump operation.

FIGURE 2 (left). Friction loss within the gathering system is minimized through the installation of full-sweep, welded ells. The development of expansion is compensated by sleeve-type couplings. The illustrated line gathers exhaust steam from the three 20-inch mud pumps for transfer into the trunk line.

FIGURE 3 (right). Each end of the preheater is swaged above with the base of the shell and connecting line on the same plane, thereby facilitating the rapid removal of steam condensate. The gathering lines consist of light weight, spiral welded casing attached with quick coupling flanges.

volves an expenditure of approximately $530. Thus, under the above conditions, the unit will pay out in less than 18 days, or at least during the process of drilling one well.

Structural Detail

This preheater unit has the appearance of many stack blower manifolds found on steam rigs; however, the addition of the simple welded coils, plus the proper handling of water through the system, makes additional advantages available.

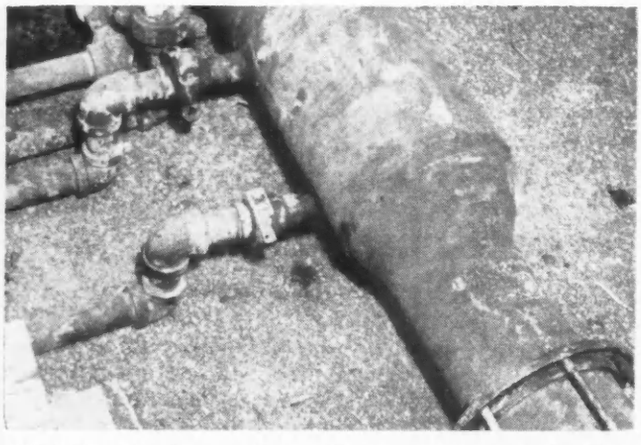
Constructed of standard oil field parts, the unit includes the 16- or 18-inch casing shell with two-inch tubing coils welded inside. This particular installation is equipped with 15 runs of coils, but the number of coils can be tailored to fit the inside diameter of the shell. Of course, provision must be made to permit a sufficiently large volume of steam to blow through the system to heat the water tubes. Prefabricated, 180-degree elbows are welded to the end of the two-inch tubing runs to permit the installation of a maximum number of heat exchanging coils.

Figure 2 illustrates the manner in which the exhaust lines from the mud pumps junction with the main trunk line. It will be noted that full-sweep, welded connections have been employed to minimize the development of friction factors and reduce back pressure at the pump steam-end. Quick-coupling, sleeve-type flanges are used in each instance to expedite the rigging-up process and compensate for the occurrence of expansion within the system.

A problem often encountered in horizontal preheater units is the accumulation of steam condensate in the lower section of the vessel. To eliminate the occurrence of this condition, each end of the preheater shell is formed with an off-center, welded swage that places the base of the preheater shell and the attached feed line on the same plane. With this provision, all condensate is immediately exhausted through the system by passing steam. Thus, there is no need for concern about water logging the system with a resultant excessive back-pressure to the exhausts nor is there a great possibility of rapid corrosion to the inner base of the shell. This construction feature is illustrated in Figures 3 and 6 where it may again be noted that quick coupling, sleeve type flanges are employed.

Like all component parts of a rotary rig, portability is of basic importance. For this reason, a light weight 5/8-inch spiral welded pipe has been installed in the exhaust steam feed system to the preheater. It is possible for two men to move and assemble the complete feed system to the preheater and a truck, equipped with gin-poles, can spot the preheater in minimum time.

Figure 4 illustrates the manner in which the feed and discharge lines are connected into the preheater system. The line on the left is feeding hot water from the boiler feed pump into the preheater system while the line on the right is injecting superheated



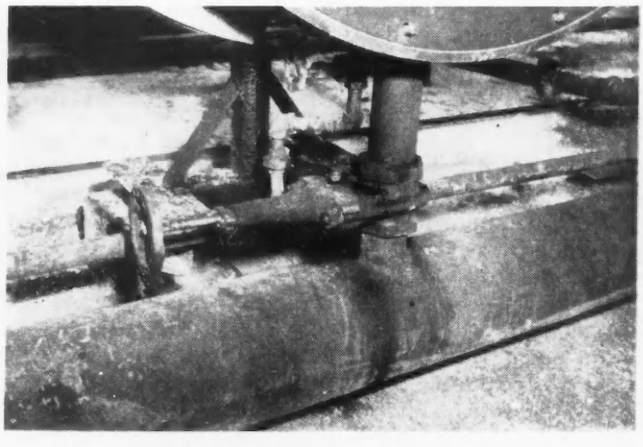


FIGURE 4 (left). The injection and discharge of the two-inch preheater coil extend from the shell at the derrick end of the boiler. Hammer-type unions permit rapid assemblage of the unit while expansion of the lines is compensated by the half-swin gs.

FIGURE 5 (right). Valves are installed in the stack blower line to permit isolating a boiler for washing or repairs.

water directly into the boiler. Fabrication of this part of the unit is relatively simple since the coils are constructed and inserted into the shell prior to the forming of the swaged ends. Hence, there is sufficient space to slip the feed and discharge nipples through doors cut in the shell and weld a heavy bead around each nipple extension to eliminate the possibility of steam leaks. Of course, welding of the outer shell is not as exacting a job as fabricating the inner coil since at no time is there more than 15 pounds per square inch on the shell. The inner coil, carrying the boiler feed pump pressure, must be welded with heavier bead and more exacting precision to withstand higher pressures.

Hammer-type unions are connected to the two-inch injection and discharge elements of the preheater to assist in rapid rigup and tear-down practice. A half-swing, installed immediately behind the hammer union, will compensate for any expansion developed within the two lines. This feature is also of tremendous aid in the process of rigging up.

The preheater unit serves greater utility by supplying exhaust steam in well governed quantities to the boiler stack blowers. An inspection of Figure 5 will illustrate the manner in which a short four-inch nipple is welded into the preheater shell. A four-inch gate valve is situated immediately above the short nipple to permit closing individual boilers for washing or repairs.

It is often desirable to establish a small amount of back pressure within the preheater system to facilitate the better and more efficient heating of the coils as well as increased draft through the stack blower system. To provide this back pressure, a four-inch valve is stationed at the swedged exhaust end of the preheater for complete regulation. Illustrated in Figure 6, this valve is seldom closed; however, if a light quantity of exhaust steam is available, it is possible to greatly enhance the efficiency of the unit with corresponding benefit to the entire boiler system by merely adjusting the valve.

Extensive field testing of this unit has resulted in the construction of a larger, more flexible preheater on other Falcon Seaboard rigs. By increasing the diameter of the shell to 18 inches and installing 600 feet of two-inch coils, it has been possible to completely eliminate the need of a preheater ahead of the boiler feed pump. Another feature of the new unit is the presence of bolted ends rather than the welded swage installations. Furthermore, the exhaust end of the shell is equipped with a two-inch outlet installed in the lower end of the shell to permit more rapid exit of steam condensate. A two-inch collar is welded at this condensate outlet to allow the installation of a sufficient number of fittings to route the condensate away from the boilers.

The redesigned preheater does offer definite advantages. However, it is not planned to install this type of unit on rigs equipped with primary preheaters unitized on the boiler feed pump unit. The new unit will offer greater utility where independent preheaters are installed ahead of the boiler feed pump. By installing the 18-inch preheater, it is possible to remove from service the remaining preheater, which operates ahead of the boiler feed pumps—thereby eliminating one truck load of equipment.

FIGURE 6. Back pressure within the preheater can be controlled conveniently by adjusting the four-inch valve at the exhaust end of the shell. This consideration is of basic importance to the efficient operation of the preheater unit.

Proper Preheating of Feed Water

The preheating of boiler water is a widely practiced operation; however, many operators increase the temperature of the water ahead of the boiler feed pump. This method is satisfactory with definite limitations since the feed pump will lock, and packing is readily destroyed if the water temperature exceeds 180°. The net result is that sufficient water is not delivered to the boilers. The introduction of very hot water is a definite asset to the efficient operation of boilers; however, it is not possible to increase the water temperature to a desirable level when the heating process is completed ahead of the boiler feed pump. With the installation of the discussed preheater, it is possible to increase the temperature of the feed water to a maximum through the efficient utilization of exhaust steam that is often wasted.

Field operation of the preheater has revealed just one disadvantage of any significance. The boiler feed pump pressure is slightly increased. Although the pressure increase is readily noticeable, no difficulty in pump operation or the maintenance of parts has been experienced. The service life of the packing and other expendable parts has not been seriously affected.

In contrast, the advantages of the preheater unit encompass increased boiler efficiency, reduced fuel costs, portability and lower feed pump maintenance cost.

About the Author

C. W. (CHARLIE) ALCORN, vice president of Falcon Seaboard Drilling Company, began his career in the oil industry in 1918 after attending the University of Illinois. Following service in World War I, he became affiliated with Globe Oil Company and later the Roxana Petroleum Corporation, which ultimately became a part of Shell Oil Company. In 1924, Alcorn was transferred from Oklahoma to South Bend, Texas; and in 1927 to Dallas as assistant general superintendent of the Central Division for Shell Oil Company. In 1934, he established his own business, which was soon organized as the Falcon Seaboard Drilling Company with F. E. Bernsen and T. N. Law as partners. From a simple beginning, the Falcon company has mushroomed into an organization with widespread producing interests plus 18 rigs operating in the U. S. and three in Canada. Alcorn is active in The American Petroleum Institute, Independent Petroleum Association of America, Texas Independent Producers and Royalty Owners Association, Texas-Midcontinent Oil and Gas Association, and American Association of Oil Well Drilling Contractors.

Gas REPLACES DRILLING MUD IN SAN JUAN BASIN OPERATIONS

By GILBERT M. WILSON
WORLD OIL Staff

THIS ARTICLE describes the technique of circulating gas rather than drilling fluid in completing wells in the Blanco area of the San Juan Basin in northwestern New Mexico. Employed by the El Paso Natural Gas Company, the procedure has increased the penetration rate from a former average of 150 to 200 feet per day to one-half to one foot per minute. When drilling mud was used as the circulating medium, 80 feet represented a good bit run; however, by circulating gas, it is possible to make 300 to 400 feet of hole per bit.

A DRILLING technique which employs natural gas instead of drilling mud for the circulating medium is being used so successfully that it may become standard operating procedure in the drilling or cleaning-out of wells which penetrate very porous formations, particularly pay zones, and other intervals where lost circulation and related problems commonly occur. El Paso Natural Gas Company, in the course of developing its natural gas producing properties in the Blanco area of the San Juan Basin in northwestern New Mexico, found that, in using conventional drilling methods to drill into the 800-foot pay section of 5000-foot wells, costs were high, an excessive amount of time was required to complete a well, and the risks of fishing jobs when wells were being cleaned out after being shot were considerably higher than usual.

Seeking a method by which these costs and drilling time might be reduced, executives and engineers of the company began to use natural gas instead of conventional drilling mud during the drilling-in and subsequent cleaning-out operations. The basic idea, that of using air in the drilling of core holes in desert areas where water is scarce, admittedly is not a new one, but it is believed that this was the first time the idea had been used successfully on deep wells in which generally conventional rig equipment was used.

Initial results of the operation in their first well were so successful that the method was used on another well and, at the time of this writing, was being used on a third well. Several cleanout jobs also were performed with the new technique. In recent weeks one or two other operators in the area have turned to the new method. The practice, insofar as the operations of El Paso Natural Gas Company are concerned, has been sufficiently standardized that it is felt a full report now can be given of the new technique. It is realized, of course, that as more data and experience are gained, improvements doubtless can and will be made in both equipment and the techniques in handling it.

That the technique has yielded results offering more than usual encouragement to the continued use of the gas circulation operation is seen in the following summarized results:

- Penetration with conventional rotary and drilling mud methods, which formerly was in the order of 150 to 200 feet per day, averages from one-half to one foot per minute with gas.
- A bit which used to make 80 feet of hole—and this was considered a good run—now can be counted upon to make from 300 to 400 feet of hole with the gas technique.
- Porous formations, in this case the pay zone, now can be drilled without fear of their becoming contaminated either with mud or lost circulation materials, and with greatly reduced chances of costly fishing jobs.

In the Blanco area, where most of the operations involving the gas drilling technique so far has taken place, the majority of the wells are drilled to 5000-5100 feet. The pay formation is an 800-foot interval of alternating sands and shales, classified as the Mesa Verde section of Upper Cretaceous age. Actually, the section is made up of three pay formations, these being identified as the Cliff House, which varies from 10 to 70 feet in thickness; the Menefee formation, averaging about 600 feet in thickness; and the Point Lookout formation, averaging from 100 to 150 feet in thickness. Productivity of the pay formations varies from well to well, but the entire section usually is produced as a single pay zone. The gas produced is considered dry, but in some areas a small amount of distillate is produced along with the gas.

Completion Program

Typical completion procedure generally has called for the drilling of 12¼-inch hole to about 300 feet, where a string of 9⅝-inch surface casing is cemented. An 8¾-inch hole then is drilled to the top of the Cliff House, the first of the gas pay zones, which is topped at between 3700 and 4000 feet. A string of either 6⅝-inch or seven-inch casing is cemented at this point. The pay zone then is drilled with six or 6¼-inch hole, this section of the hole being left open to production.

Following the completion to total depth, the open hole pay section usually is shot with solid nitro, sizes of the shots ranging anywhere from 1600 to slightly more than 2300 quarts, with some sands being shot heavy and shales receiving lighter charges. After the shot, with previous

methods, the hole was cleaned out either with rotary or cable tools, it being more generally the latter, as problems of lost circulation and possible plugging of porous sands were avoided. Even with cable tools, the process of cleaning-out and placing the well on production often was slow and tedious, with fishing jobs in the shot and badly caving formations often occurring. Some of the fishing jobs consumed a week or two and up to as much as several months. Even on a perfect job, where no trouble was experienced, it usually required, with cable tools, from three weeks to a month to drill through the pay zone; and if good luck still held, another one to two weeks to shoot, clean out and put the well on production. During all these operations, formation gas escapes from the well, resulting not only in a substantial loss of production, but forming a very real hazard to personnel as well.

Searching for a more economical and speedier method of completing wells, the company began to investigate the possibility of using natural gas as a circulating medium, using techniques patterned after those occasionally employed by light geophysical rigs when drilling shot holes in very arid areas where hauling of water is impractical and too expensive and where cuttings are removed from the hole by compressed air. In the Blanco area, obtaining the gas presented no serious problem. In most cases, drilling operations seldom were not too far from a gathering line or transmission line which traversed the area, and a short supply line readily could be laid to bring gas to the drilling well.

Minimum Change-over Required

Modification of existing drilling equipment proved no problem as only slight changes in the mud standpipe and wellhead hookups were necessary. One of the most important considerations was to make sure that the supply gas used was dry. Otherwise, with a wet gas, the fine dust and cuttings brought out might tend to cake up in the hole instead of being blown out of the hole. It was found that line pressure of the gas source should be held at between 500 and 600 pounds per square inch. If pressures are higher than this, a regulator should be used to hold it down to that recommended point before it is brought into the location. Connected in to a meter run (Figure 2) located a safe distance from the rig, the source line should have a blowdown valve and a block valve just upstream of the meter run and another blowdown just downstream of the run.

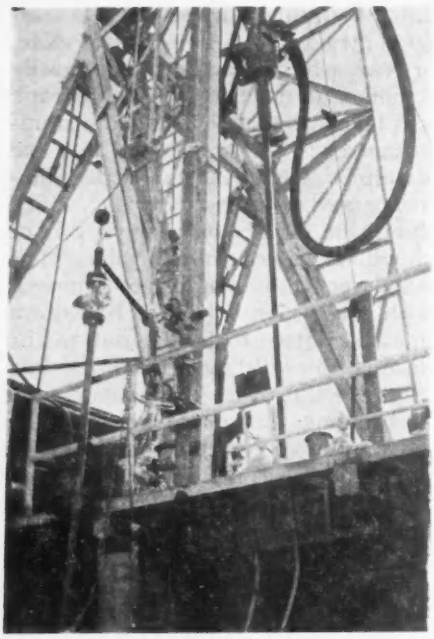
Source gas is piped into the base of the standpipe at a level convenient to the rig floor so that valves and controls easily can be reached by men on the floor. In the installation photographed (Figure 3) a 300-pound lubricated plug valve serves as a master control valve. A flow control valve, or bean, while it had been temporarily removed at the time the photograph was taken, should be installed just upstream from the connection into the standpipe. Use of this flow valve eliminates need of the master valve, which should be either completely open or closed, as a controlling valve. The standpipe also should be equipped with a two-inch valve and blowdown line, the latter to be led out to the flare a safe distance from the rig. Figure 4 illustrates the hookup used in bringing the source gas into the rig standpipe. No change is made in the rotary hose, swivel, or kelly connections.

The casinghead and control equipmen hookups likewise require little change from those used in conventional drilling. As shown in Figures 5 and 6, a full-opening master valve is attached to the top of the casing. It is intended that this valve be left on the well permanently after completion of the well.

Immediately above the master valve is mounted a cross tee or drilling spool. For drilling, a spool with four-inch or two-inch side outlets is used. Above the spool are installed blowout preventers and drilling head. Gas return and cuttings are taken off at the spool outlet and led off directly to a flare some distance from the well, or, as in the case of the installa-

FIGURE 1 (left). View of El Paso Natural Gas Company rig in Blanco area of San Juan Basin. Little modification of existing equipment is required to adapt rig to use of gas as circulating medium. Return line leading to flare is in foreground.

FIGURE 2 (right). Meter run installation at point on edge of location where supply gas enters rig system. Line is equipped with a blowdown valve and block valve on upstream side of the installation. Another blowdown valve is on the downstream side.



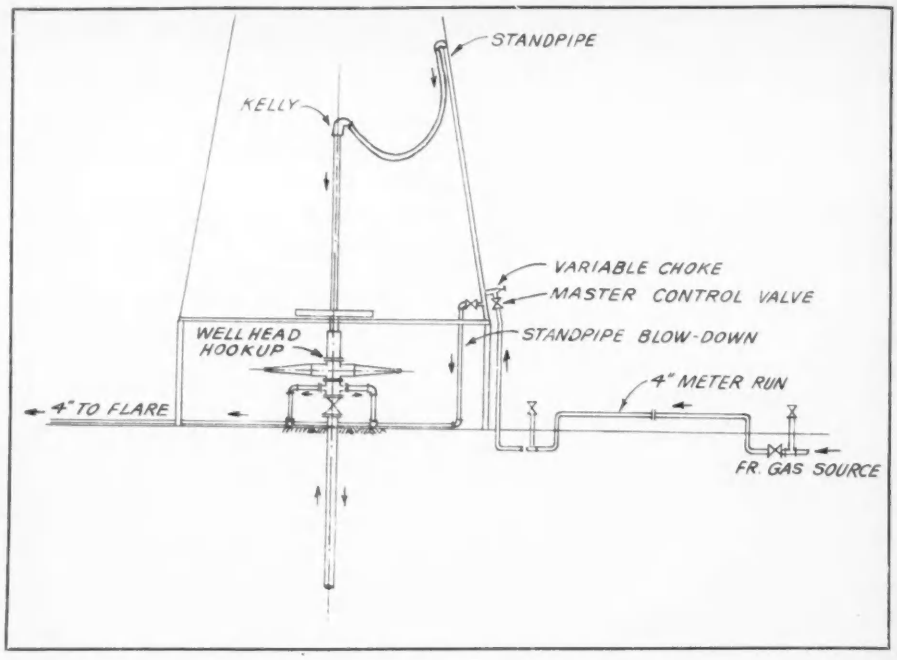


FIGURE 3 (left). This shows the two-inch source gas line (left) at point where it is tied into mud standpipe. Plug valve in incoming line serves as a master control valve. The flow control valve (shown standing on floor beside standpipe and which had just been removed temporarily) normally is connected into line just upstream from standpipe connection. Standpipe blowdown valve is visible above other connection. Under normal operating conditions blowdown valve is connected into line leading to flare.

FIGURE 4 (right). This illustrates diagrammatically the gas supply and gas circulating system as it is used by El Paso Natural Gas Company.

tion pictured in Figure 7, through a dust collector and from there on out to the flare. It is recommended that the flare be located at least 400 feet from the rig and that a pilot light be installed at the flare to ensure instant lighting of the flare whenever operations start up following a shut down or upon making a new connection in the drill string.

Only a slight modification is made in the bits used with the gas circulation technique, this alteration being made in the size and number of the fluid passages. This change, which costs about $35 per bit for the six and 6¼-inch size rock bits, consists of filling the regular fluid passages and drilling six new 5/16-inch holes, three to direct the flow of gas to the teeth of the cones and three to direct gas to the shank and bearings of the three cones. The latter group provides the desired cooling of the bearings.

Drilling Procedure With Gas

Drilling operations, generally speaking, are carried on in much the same manner as when regular drilling mud is used. As would be expected in any drilling operation, there are several principal steps, the proper order of which should be followed to obtain the best results and to ensure maximum safety for all personnel. A summary of the steps necessary to achieve best results, and which currently are followed by crews of El Paso Natural is given in the following.

While drill pipe is being run in the hole, the source gas line block valve and the master control valve at the standpipe are closed and the blowdown line valve in the standpipe is kept open. The kelly is attached in the usual manner and other preparations are made to start drilling. At this point, the meter run block valve is opened and gas pressure is allowed to come up to the master control valve on the standpipe. A check then is made for leaks in the line up to this point.

The variable choke on the standpipe inlet then is set for a small flow of gas and the standpipe blowdown valve is closed. The standpipe master control valve next is opened fully and gas is allowed to flow down through the drill pipe, out the bit, and back up through the casing. Gas is allowed to flow for approximately five minutes to assure a thorough purging of the system and to make sure the drill pipe, bit or other segment of the system were not plugged during the running-in of the drill pipe. The returning gas, coming out through the drilling spool outlets, is conducted out to the flare. Following a thorough check of the system for any possible leaks, the flare then is lit.

Gas flow then is increased to where the meter indicates a flow rate of approximately 1600 Mcf per day. Pressure indicated at the standpipe, after a few minutes flow, should read approximately 250 pounds per square inch. Following a check of all fittings and connections, drilling then is commenced. Although drilling conditions may warrant the modification of table speed and weight on the bit to obtain the best results, the company has found that optimum conditions for drilling into the pay formation call for rotating at approximately 60 revolutions per minute and with about 10,000 pounds weight on the bit. Drill string used for drilling new hole has been a conventional string of 3½-inch drill pipe including three, 4¾-inch x 30-foot drill collars.

After the kelly has been drilled down, gas is allowed to flow for another minute or so, after which the standpipe master control valve is closed. The kelly then is picked up a few feet, the standpipe blowdown valve is opened, and pressure is allowed to drop to zero, the pressure being watched at the standpipe gauge. The purpose of picking up the string in this manner is to lift the bit off bottom and to make sure the ports are not plugged, assuring the complete reduction of pressure inside the drill pipe as well as in the hole. After the pressure is down to zero, the kelly connection may be broken out. The new joint is made up on the kelly and lifted from the mouse hole and the standpipe control valve then is cracked sufficiently to make sure the new joint is purged of any foreign material that might have lodged inside it. After the new connection is completed, the bit is lowered to within about two feet of bottom, the control valve is opened, and gas is allowed

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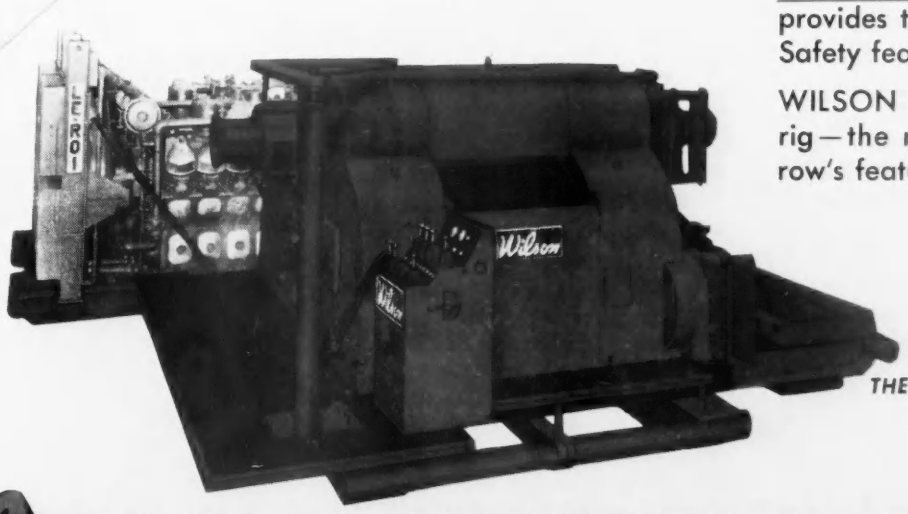

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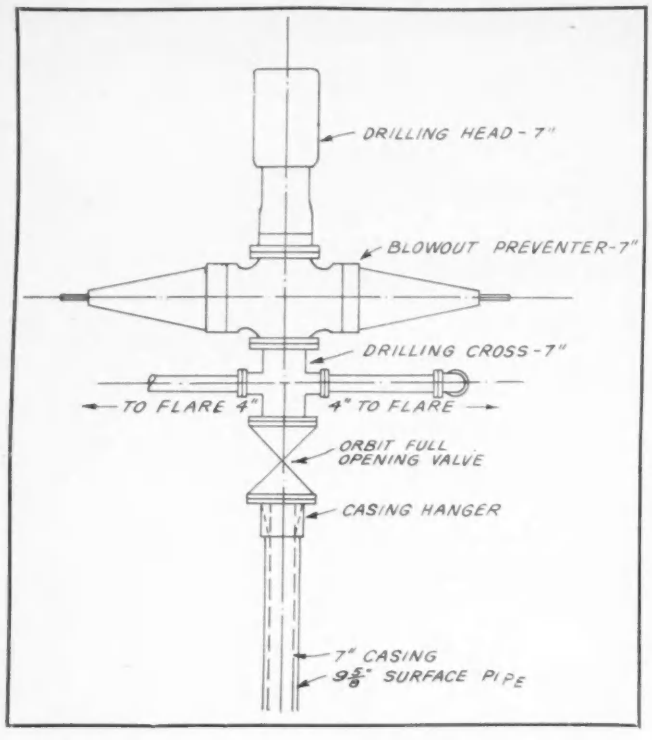

FIGURE 5 (left). Diagrammatic drawing shows manner in which wellhead is hooked up for drilling-in with gas circulation technique. Full opening valve below drilling cross normally is allowed to remain on well after completion.

FIGURE 6 (right). View of actual wellhead installation on well equipped for drilling with gas circulation method. For several reasons the hookup on this well was not exactly the same as that shown in Figure 5, but operation was essentially the same. Tee with single four-inch outlet was used with good results. Four-inch return line leads off to left of drilling tee.

to circulate for two minutes before drilling is resumed.

As a guide to the driller on the well, the company has prepared a short table which, when the standpipe pressure is known, will tell the driller the approximate volume of gas that is going through the system. This table, which, of course, would be modified by any changes in the size of standpipe, rotary hose or drill string used, is given in the following:

Standpipe Pressure	Volume
250 psig	1,600 Mcf/d
300 psig	2,000 Mcf/d
350 psig	2,400 Mcf/d
400 psig	2,800 Mcf/d
450 psig	3,200 Mcf/d

Frequent checking of standpipe pressure and comparing with the table enables the driller to quickly detect a plugged bit condition or determine whether any restrictions have occurred in the casing or flow lines.

Drilling Rate Increased

Some remarkable results have been obtained through the use of this gas circulation technique. As stated earlier, the average rate of penetration (with conventional mud circulation and under ideal conditions), with no stuck pipe or lost circulation troubles occurring, formerly was in the order of 150 to 200 feet per day. Using the gas circulation technique, with everything running smoothly, penetration is in the order of from one-half to one foot per minute. The record of the first well drilled by the company with this technique actually was 0.64 foot per minute, based on actual drilling time.

A detailed record was made of the drilling progress in this first well and the significant parts of it are given in Table I. In this well, seven-inch casing was cemented at 4255 feet and total depth was 5090 feet.

In this well the producing formations penetrated were Cliff House, topped at 4310 feet; Menefee, topped at 4346 feet; and Point Lookout, topped at 4963 feet.

Increased Rock Bit Life

Contrary to what might be expected when drilling a well "dry," without mud to lubricate and cool the bit, rock bit life was found to be surprisingly good. This has been the findings, at least, in the drilling of the three wells not including cleanout jobs, the company so far has drilled with the new technique. Very careful records were kept on the initial well and, as can be seen in the above tabulated data, it was found that bits were being pulled green, wear on teeth and bearings being far less than had been expected. The experience has borne out the contention of many engineers that the cooling effect of the gas, in passing through the ports and expanding directly over the bearings, is sufficient to prevent overheating or abnormal wear of the bearings.

Figure 8 shows the three bits used and referred to in the tabulated record (Table 1) of the first well drilled with the gas circulation technique. As can be seen, the first bit, at left end, which made 153 feet of hole, still was not worn to the extent that many bits are when pulled after a normal run with conventional mud circulating drilling operations. This relatively small degree of wear is all the more significant when it is realized that the Cliff House formation, the uppermost part of the over-all pay section drilled is an interval containing a great deal of very sharp sand. With conventional drilling with mud, it nearly always was necessary to pull the bit after passing through this formation. The bit shown in the photograph still could have made more hole.

The second bit, center, made the next 313 feet of hole and, although it still was making good hole, it was pulled as a safety measure and to observe the amount of wear that had occurred; for it was not known at that time just how much footage could be expected from a bit under the new procedure. This bit, it was estimated,

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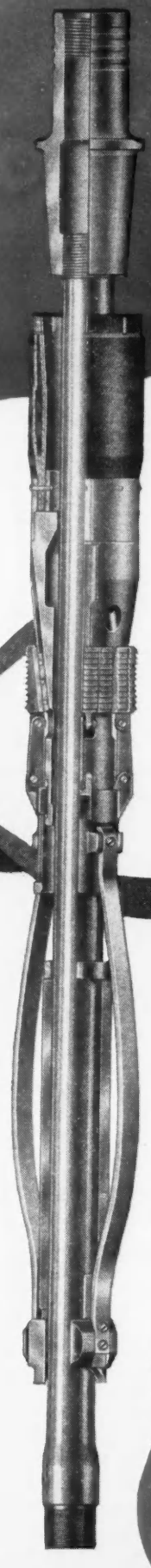

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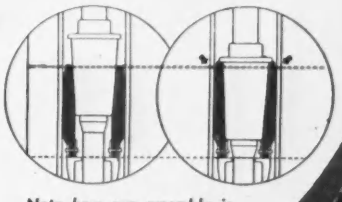

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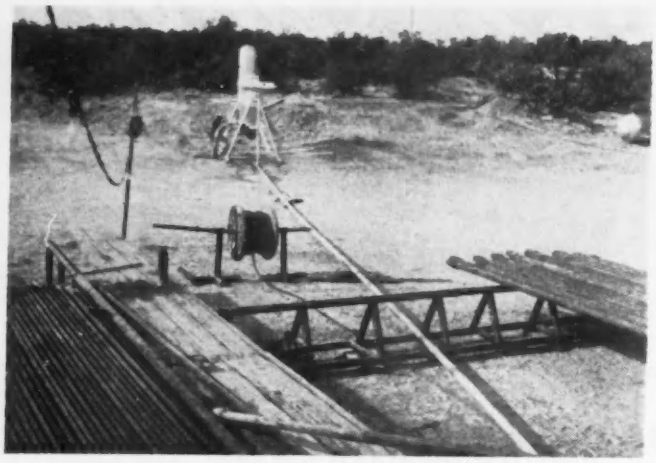


FIGURE 7 (left). View from derrick floor showing layout of return line, dust extractor and, in distance, the return line flare. Return line is four-inch size from wellhead to flare.

FIGURE 8 (right). Shown here are the three rock bits which illustrate that considerably greater amount of footage is to be obtained through use of gas circulating process. Bit on left made 153 feet of hole; center bit made 313 feet; and bit on right made 267 feet. Bearings showed generally less wear than that sustained with conventional mud drilling method.

was still good for an additional 200 to 300 feet of hole.

The third bit, which drilled the remaining 267 feet to total depth, showed so little wear that it was difficult, at first glance, to tell whether it had ever been run in the hole. The teeth were very sharp and the bearings good as new. This bit, being worn so little, was to be used in another well. It easily was good for another 300 to 400 feet of hole.

Based on bit performance so far, engineers feel that, when using gas circulation, a bit can be counted upon to make about 400 feet of hole safely in the alternating sand and shale formations of the Mesa Verde section. Eighty feet was considered to be a good average run for a similar bit when drilling with mud circulation. Bit bearings, it was found, showed less wear with the gas circulation technique than that which occurred with conventional mud circulation methods.

TABLE 1

Date	Time	Depth	Line Pressure	Input Volume at 15.025 Psia and 60° F., Mcf/D	Outlet Pitot Tube Volume Mcf/D	Standpipe Inlet Gage Pressure
5-2-51	2:50 a.m.	4263	....	....	....	....
	6:45	4321	540	4,660	5,340	....
	7:13	4323	585	1,996	2,860	....
	8:15	4375	595	2,413	....	....
	8:45	4399	633	1,384	1,750	....
	After making 153′ in five hours, bit was pulled and found in excellent condition, very small amount of abrasive effects from sand. Change orifice to 1.5". Put on new bit.					
	12:45 p.m.	4416	653	1,026	....	....
	1:15	4440	653	1,136	....	190
	1:45	4472	633	1,732	....	220
	2:15	4501	633	1,543	2,606	220
	2:45	4528	633	1,500	2,064	220
	3:25	4556	633	1,612	1,850	220 Bad
	4:15	4585	633	1,472	1,430	205 Readings
	4:50	4611	633	1,645	1,430	220 Pitot
	5:25	4650	633	1,572	1,501	220 Tube
	6:05	4678	633	1,592	2,552	220 Plugged
	6:30	4700	....	....	....	....
	Pulled bit after 313′ and six hours in hole. Bit in perfect condition, no marks or scars. Put on new bit.					
	10:50	4745	633	1,840	3,190	275
	11:20	4774	633	1,465	2,620	220
5-3-51	12:13 a.m.	4800	633	1,765	....	270
	12:55	4835	633	1,654	2,482	250
	1:37	4870	633	2,068	3,280	305
	2:17	4895	633	2,405	3,630	350
	3:05	4930	633	2,110	3,230	310
	3:45	4955	633	1,280	2,324	210
	4:35	4985	633	2,222	3,330	260
	5:02	5005	633	1,287	2,750	250
	5:17	5025	633	1,666	3,230	260
	5:42	5035	633	1,970	3,330	300
	6:04	5060	633	1,818	3,430	275
	6:22	5065	633	2,250	3,430	325
	6:40	5085	633	2,312	4,220	325
	6:45 (T.D.)	5090	633	2,312	4,220	325

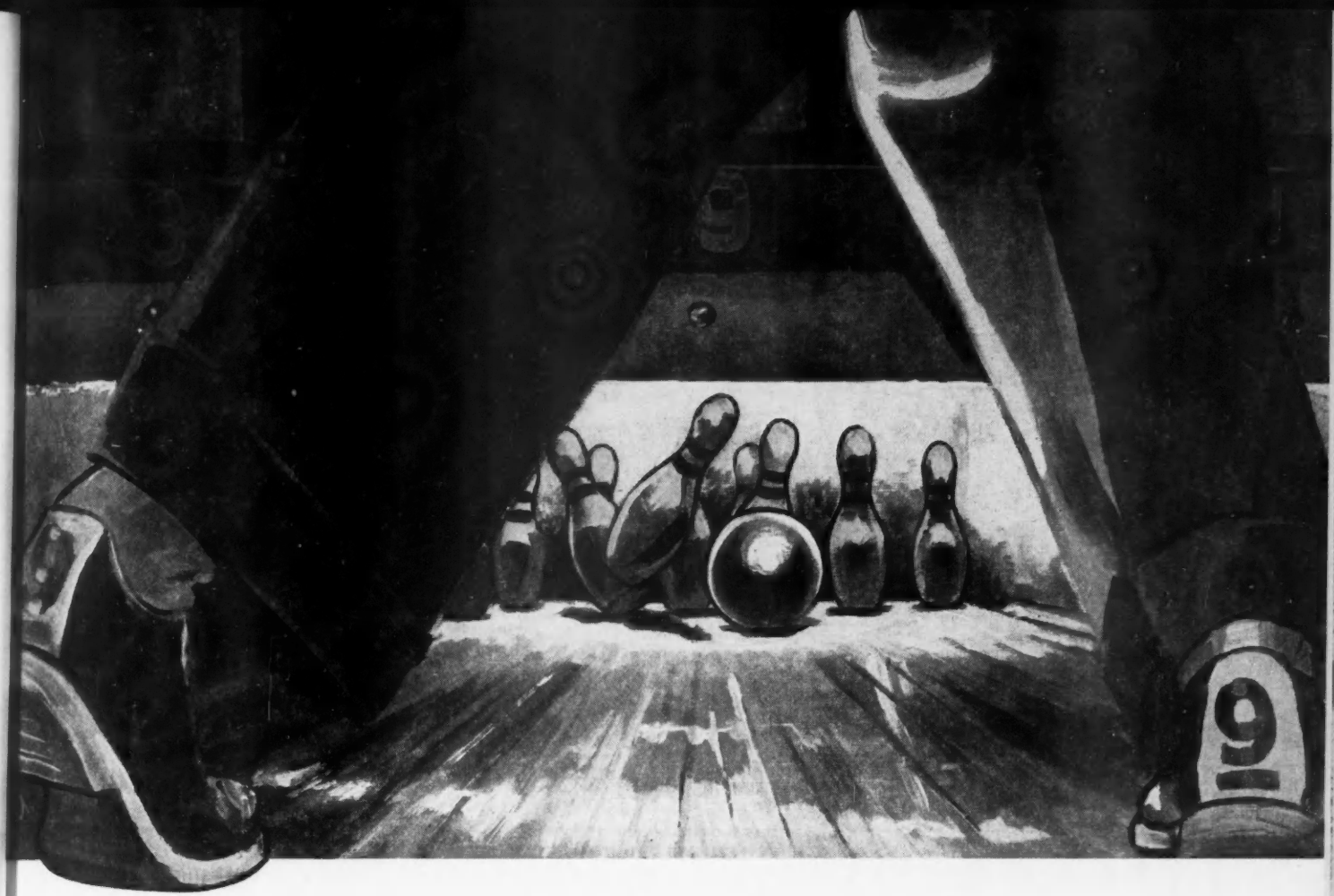
After making 267′ of hole, pulled bit and found perfect. Nine hours drilling.
Flow before shot (natural)—140 Mcf.
Made 827′ of hole in 27¾ hours. Actual drilling time, 21½ hours. Average, 0.64 ft./min., or 1.55 min./ft.
Total amount of gas used—1,700 Mcf.

Cuttings in Powder Form

Cuttings, for most formations, particularly the hard sands and shales, emerge from the well in an extremely fine powder form. A high percentage of the returns are so fine, in fact, that the material feels like a fine grade of face powder. (See Figure 9.)

The dust extractor referred to (Figure 10) is a unit only recently designed and installed by the company. It consists of a chamber in which is installed a number of vertical baffle plates designed to effectively knock out the dust and other cuttings. The material collects in the inverted cones from which it is blown out at periodic intervals.

In the early stages of experimenting with the new technique, before the dust extractor and flare were installed on the return line, engineers found it of considerable interest to watch the cuttings as they emerged from the open end of the four-inch return line near the edge of the location. It is estimated that a minimum gas velocity of about 3000 feet per minute is required to carry the cuttings out of the hole and, on that basis, it required only a minute or two for cuttings to be brought to the surface. Watching the dust as it emerged from the flow line, it was easy to tell, to a very close degree, what formation the bit was in at any given time. Shales, for example, generally showed up as a brown "fog" in the gas



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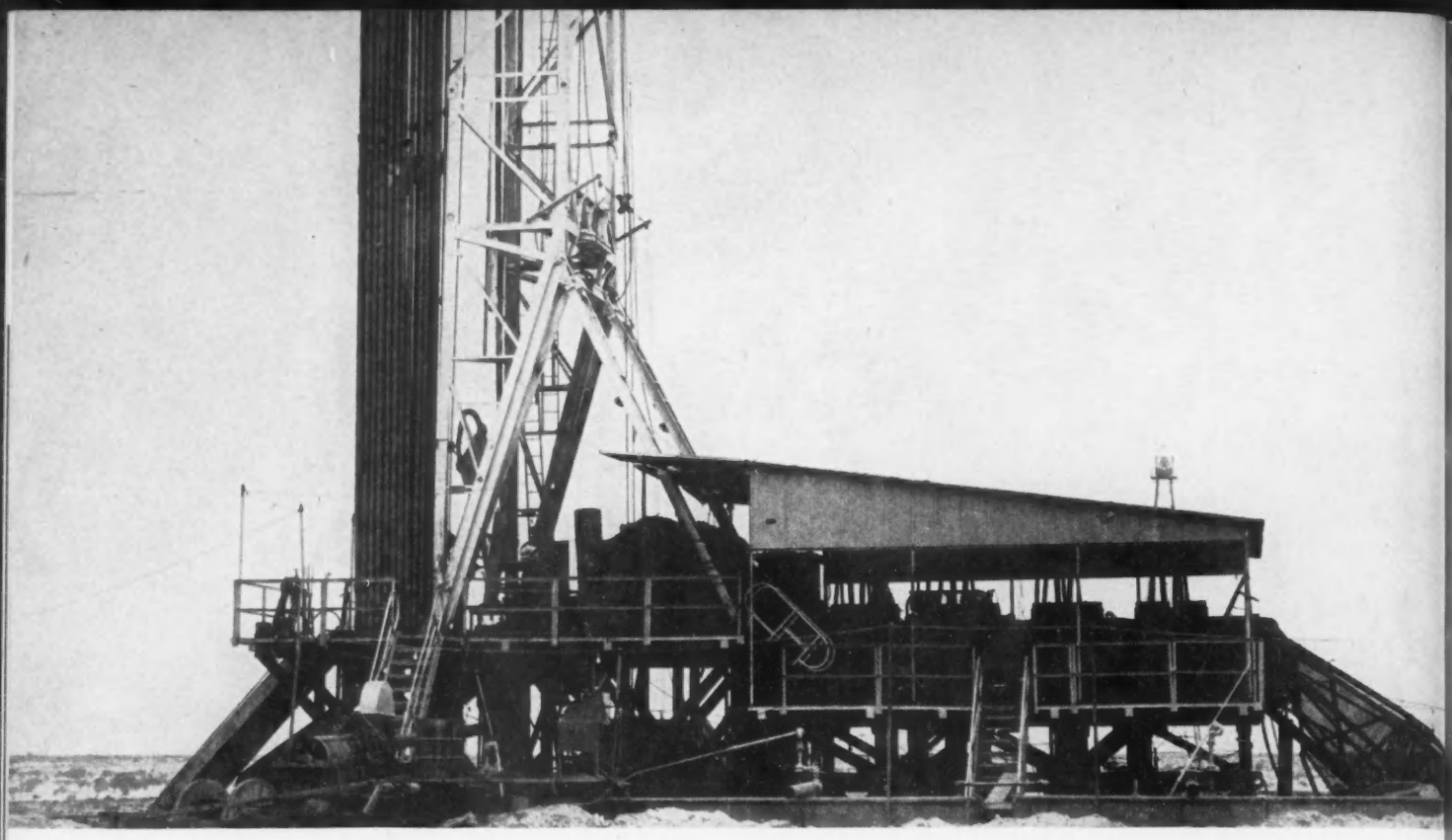


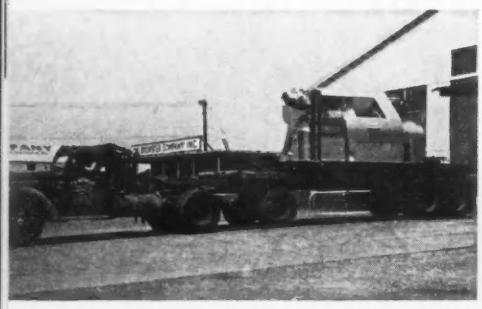
BREWSTER N-12

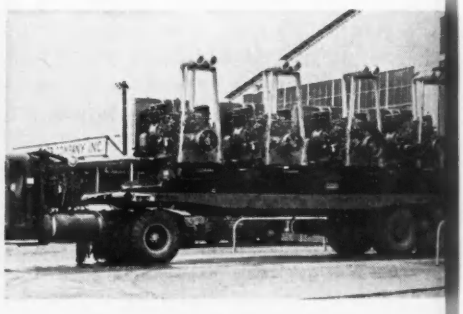
For Deepest Drilling

Brewster's "Golden Rig," the N-12 is powerful and rugged . . yet it's easy to move.

It has 8 drum speeds, 8 rotary speeds, two 850 h.p. pump drive sheaves and it is powered with four 400 horsepower engines.

After a year in the field the "Golden Rig" has proven the value of its "Extra Beef."

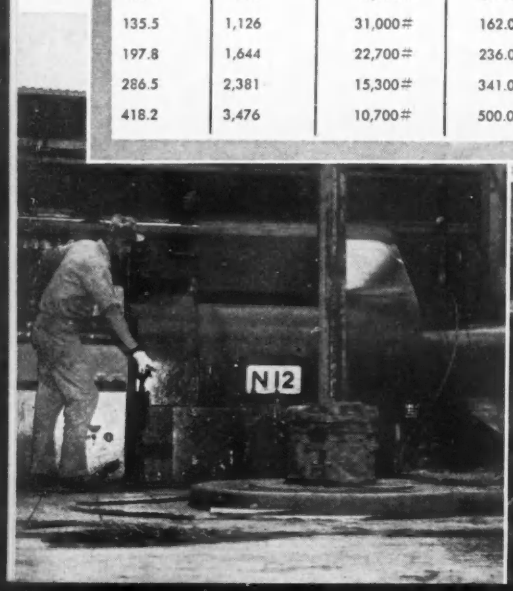


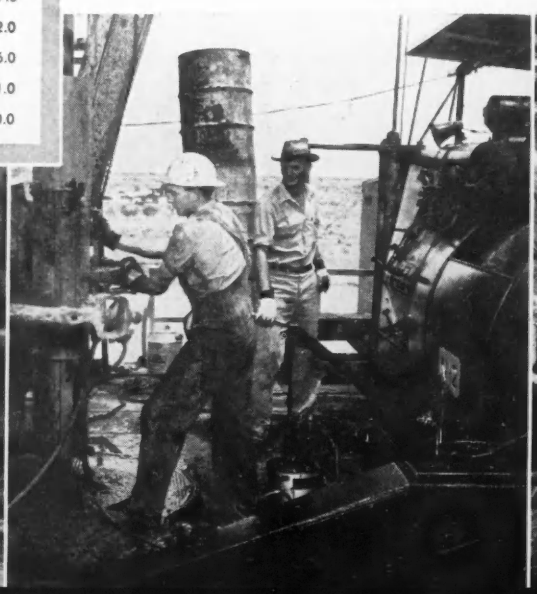


Drum Speed	Line Speed	Line Pull	Rotary Speed
34.4 RPM	285'/min.	126,000#	56.2
50.1	416	89,000#	83.5
72.6	603	59,000#	122.0
105.9	880	42,000#	177.0
135.5	1,126	31,000#	162.0
197.8	1,644	22,700#	236.0
286.5	2,381	15,300#	341.0
418.2	3,476	10,700#	500.0

The N-12 is easily moved. Penrod uses only standard transportation equipment for hauling the three major components of the rig from one location to another.

Penrod's "Golden Rig" in McElroy Ranch field, Texas, drilling its third deep well.





"I Like the Extra Beef in Brewster's N-12"

Claude Roberson,
Drilling Superintendent
Penrod Drilling Company

"Our Brewster N-12 has drilled two deep tests and is on its third well. In its first year of operation we have found out that it has plenty of extra beef under that tough hide. That's why we haven't had to shut it down a single day for maintenance."

"BEST RIG I'VE EVER RUN"

"My N-12 has plenty of power to pull a long string out of the hole in a hurry and when it's drilling, there's no vibration, no matter how deep or how big the hole."

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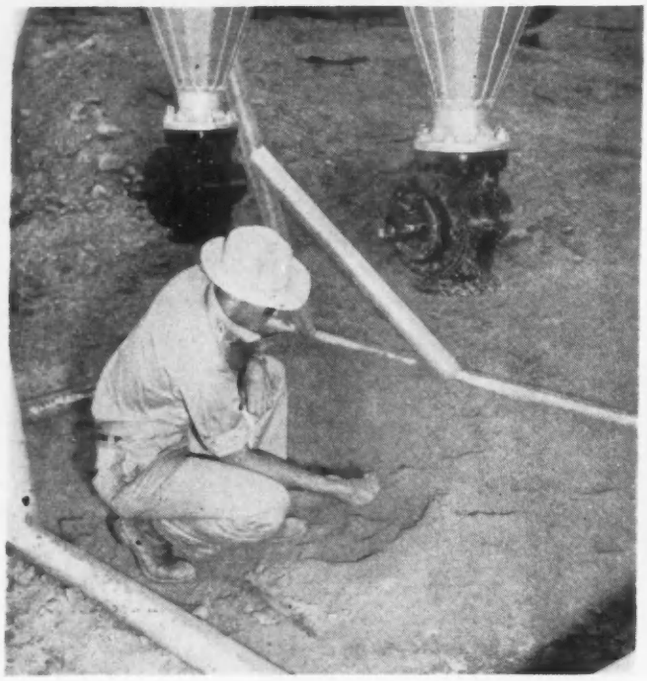

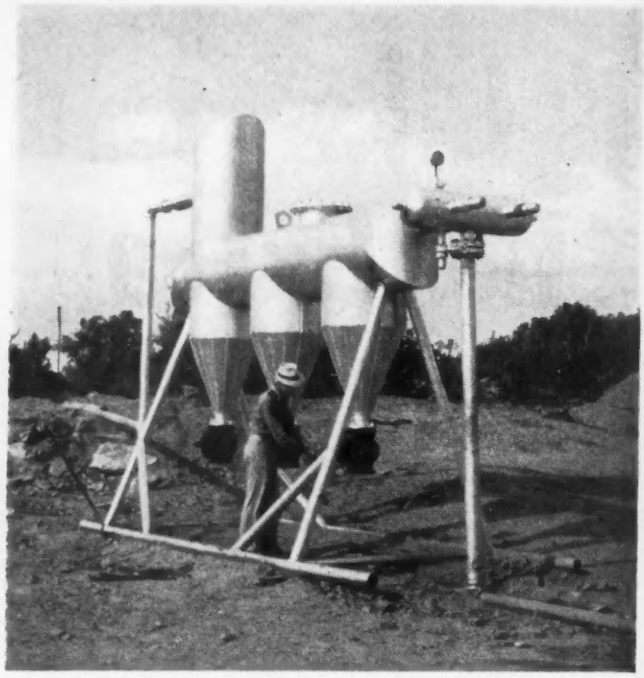

FIGURE 9 (left). Geologist is shown examining accumulations of fine powdery returns that have just been blown down out of dust extractor. By far the larger part of the returns are extremely fine, having the texture and "feel" of fine face powder.

FIGURE 10 (right). Dust extractor, designed and built by El Paso Natural Gas Company, was installed in gas return line midway between rig and flare to facilitate collection of cuttings. Series of baffles in horizontal portion of extractor knocks out cuttings which fall into inverted cones below and from which they are blown out periodically. Unit is skid-mounted for easy hauling between locations.

stream; sands showed up as a white or cream color; and coal strata encountered were revealed when the gas stream turned to a pronounced black.

Although most of the cuttings came out as a fine powder, it was noted that occasionally fragments up to as much as one-fourth inch in diameter were recovered. It was found that cuttings are the finest when the hard formation type rock bits are used and coarsest when soft formation type bits are used, the latter type bit having a longer tooth and being designed more for shales and softer formations. The extent to which formation material is ground up was revealed following the microscopic examination of returns from a known sandstone formation. The sand grains, as such, seldom were returned; instead, the fragments nearly always appeared as crushed pieces of individual sand grains.

Used in Cleaning Up

The foregoing has been the experience and findings based on the drilling of new hole through the gas pay formations. This technique is not limited to new hole, however, as equally good results are being obtained in the drilling-out and cleaning up of the hole after the formation has been shot.

As mentioned previously, practice in this part of the San Juan Basin has been to drill the hole with rotary tools to the top of the pay, set pipe, drill through the pay, usually with cable tools, then shoot the hole and clean out with cable tools. Under even the best of conditions, the operation of drilling 800 feet of hole through a formation that is producing gas all the while, and, particularly in the cleanout operation after the shot, subject to considerable caving, is difficult and expensive. Cable tools were preferred in most cases, however, for with rotary tools there was the danger of losing circulation, sticking pipe, and possibly injuring the porosity with drilling mud and lost circulation materials that often were used. When cable tools are employed, there probably is not the degree of plugging of the pay intervals, but a certain amount of water is used for drilling, and it is likely that this fluid does contribute to the softening of shales and sands, which in turn leads to caving and eventual sticking of tools and resultant long periods of time fishing for them. Many of the answers to these problems seem to be found in the use of the gas circulation technique, which results in little or no injury to the formation, a reduction of caving of the hole, and a considerable paring down of total drilling time.

At the time of this writing, two wells had been cleaned out (after shooting) by the company using the gas circulation method. Instead of using the heavy rig with regular drill pipe, however, tubing is used as drill pipe, the string being turned by a light swivel type, hydraulically-operated drilling head. Gas is circulated down through the tubing and up through the annulus in the same manner as is done when the pay section is drilled originally. That unusual problems are being encountered in the cleanout operations is seen in the following brief account of one job in which the gas circulation technique was used.

Open hole, from 4300 to 5080 feet, had been shot with 2370 quarts. Upon entering the hole with the tubing cleanout string, the first bridge was encountered about 700 feet off bottom. It required 2½ days of actual drilling time to clean out the well to total depth and, based on the findings in this well, it is estimated that cleanout time in most wells probably will exceed that required in drilling the pay section originally. In one instance, when the bit came to a particular bridge, cuttings were blown through the bit and up into the tubing. When they settled out, a plug was formed necessitating a round trip to clean out the ports in the bit. It was found, also, that constant caving took place and on several occasions the same foot-

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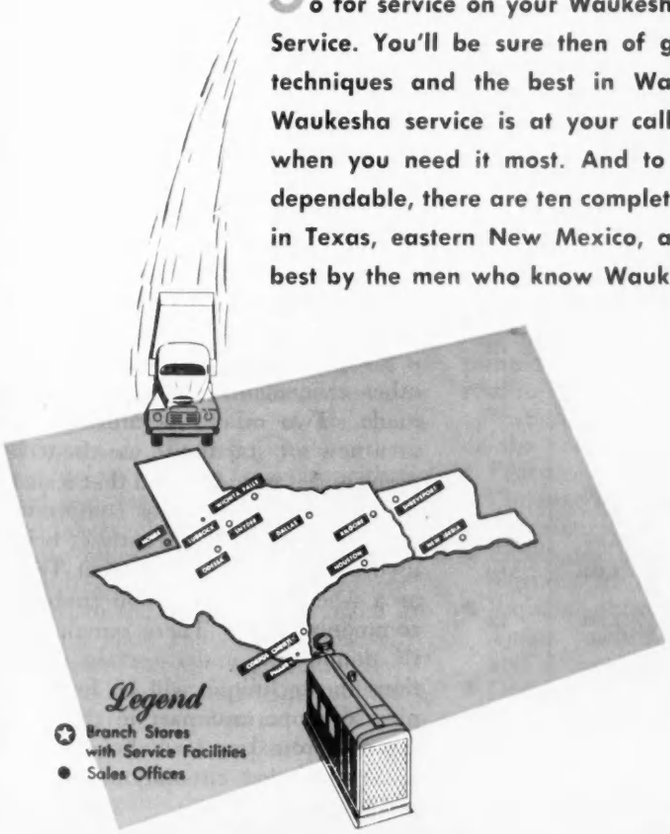

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age had to be duplicated before the hole was thoroughly cleaned. At one point, cavings stuck the drill pipe, but it easily was broken loose. As a result of some of these expeeriences, it was deecided that a higher volume of gas should be used to reduce the possibility of cavings sticking the pipe. A flow estimated to be at a 4500 Mcf per day rate, with standpipe pressure of 600 pounds per square inch, has been used in the cleanout work.

Table 2 gives the hour-by-hour record of another cleanout job that was completed successfully with the gas circulation system. Total depth of this well was 4560 feet, with casing set above the pay at 3736 feet. The swivel type drilling head and tubing string were used on this job. The short period of 12 hours required to clean out this particular well is to be compared with the days that often were required to do the same job with cable tools.

The use of the light cleanout string, combined with the gas circulation technique, has proven so successful that plans are being made to rig up a rotary unit permanently on a portable cable tool rig and mast unit. This unit then would be equipped to handle not only cleanout and completion work, but also the routine cleaning out occasionally required after the wells have been on production for some time. Drill collars have not been used in the tubing drill string, but with the contemplated new rig, one to two collars could be used in order to enable carrying about the same weight on the bit as that carried when the hole is first drilled with the big rotary rig.

The question as to whether the use of gas in this technique might be considered wasteful occasionally has arisen. If it were economically feasible to do so, the gas could be recovered and pumped back into the gathering system on the lease. The answer to this question, however, is in the fact that actually less gas is consumed in a typical drilling-in and cleaning-out operation using this technique than was lost from the formation during the long periods of drilling and cleaning out with cable tools, when the hole is open to atmosphere. When it is realized that a new well, after shooting, may produce at a rate of from 1½ to 4 million cubic feet per day for the days and often several weeks that cable tools are working in the hole, the loss of gas sustained with the previous method was far greater than the approximately 5 million cubic feet consumed in a typical gas circulation drilling job.

Personnel Safety

So far as is known to the company, there has been no accident around their rig that could be attributed primarily to the use of gas as a circulating medium and there should be no reason to expect any such accidents if the few simple rules and steps outlined earlier are observed. If the standpipe control valve and blowdown valve are operated to make sure the system is purged every time the kelly or drill pipe is broken out; if fittings are inspected periodically; and if returning gas is led off and flared a safe distance from the rig, there should be no reason to believe that the hazard to personnel or equipment is any greater than would be expected with conventional drilling methods.

Sand Blast Effect on Fittings

Contrary to what might be expected, the sand blast effect on drill pipe and bit ports is not noticeable. In fact, in the first well in which the method was used, a new string of drill pipe was run and upon completion of the well, it was noted that mill scale on the pipe had not even been removed. Some wear caused by sand blasting does occur, however, at points of reduced area, such as in the drilling spool, swages and valves in the well head and, to a more limited extent, in elbows and tees in flow lines leading away from the wellhead connections. To date, no appreciable erosion has been noted in the swivel or gooseneck fittings. It has been found that cast iron or malleable fittings suffer more erosion than do steel fittings and it is recommended that high-pressure type steel fittings be used wherever exposed to the full blast of the returning stream. The company feels that as crews become better acquainted with such details, it will become a routine duty to systematically inspect fittings for abnormal wear every time a valve or line is broken down.

Another essential operation that becomes routine is that of periodically blowing down the gas supply line to make sure no water, sand or debris has collected and which ultimately might enter and clog the system at the rig.

Like any new technique or operating practice, there doubtless will be found other improvements that still further will improve the operating efficiency of the method. Drilling time, bit wear, equipment repair and other significant cost factors now are being studied in detail by the company and it is expected that with this new data, other refinements ultimately can be made. Two other operators in the area now are starting to use the technique and it is understood that a similar technique, but using compressed air instead of gas, currently is being used experimentally in a West Texas area where lost circulation problems commonly occur. There remains little doubt that under certain conditions the technique will be found to play an important part in the drilling of porous pay formations and in areas where lost circulation problems predominate.

TABLE 2

Date	Time	Depth	Line Pressure	Input Volume at 15.025 Psia and 60° F., Mcf/D	Outlet Pitot Tube Volume Mcf/D	Standpipe Inlet Gage Pressure
5-11-51	11:30 a.m.	4352	492	....	4,590	475
	12:30 p.m.	4362	475	....	4,170	475
	1:30	4366	Stopped for repairs, gas flowing	....	....	....
	2:25	4366	Started drilling	....	....	....
	3:00	4368	410	....	3,710	385
	3:25	4371	Stopped to add joint of tubing and changed orifice from 1.25" to 2"	....	....	....
	3:45	4371	Started drilling and gas	....	....	....
	3:50	4402	Stopped to add joint of tubing	....	....	....
	....	....	410	2,780	3,710	385
	4:05	....	Started gas and drilling	....	....	....
	4:25	4433	Stopped to add joint	....	....	....
	....	....	410	2,880	3,480	385
	4:43	4464	Stopped to add joint	....	....	....
	....	....	410	2,820	4,830	425
	5:00	....	Started gas and drilling	....	....	....
	5:16	4495	Stopped to add joint	....	....	....
	....	....	442	3,150	3,180	450
	5:25	....	Started gas and drilling	....	....	..
	5:45	4525	Stopped rig, coming out for night. Pulled bit above casing			
5-12-51	9:00 a.m.	4512	Going back in with tubing and cleaning out with gas			
	1:00 p.m.	4560	Cleaned out to total depth. Blowing gas for about 2 hours before pulling tubing			
			Actual time required to clean out 208 feet of hole—12 hours			
			Total amount of gas required to clean out 208 feet of hole—1,500 Mcf.			

Log Analyzer Simplifies Electric Log Quantitative Calculations

By DR. R. G. HAMILTON

Hamilton Well Log Consultants, Tulsa

A NEW slide rule calculator for electric log quantitative analysis has been designed and produced for the log analyst. It is essentially a calculating device for solving rapidly the various, somewhat complicated formulas employed in electric log quantitative methods whereby porosity, water saturation, oil or gas saturation and sometimes permeability are obtained. The analyzer condenses numerous formulas usually presented in graphical form and a slide rule into a simple, compact, pocketsize tool. The scales permit calculations of porosity permeability and water saturations by the Tixier[1] methods and porosity and water saturations by the Archie[2,3] methods. A suitable number and range of constants are employed to allow wide application and great flexibility.

The new student of quantitative methods learns early that he must be cognizant of an impressive array of formulas and must be equipped with slide rule, numerous correction charts, and graphical presentations in order to solve problems with optimum accuracy and minimum time. He finds the mathematical solutions time-consuming and quickly resorts to charts expressing the basic equations. He observes that the ease and speed of obtaining accurate results improves as the quantity and size of his charts increases. He finds he must correctly interpolate values from logarithmic and semi-logarithmic scales and that the larger charts are desirable. The many charts soon require a binder that becomes cumbersome, when added to the other paraphernalia including slide rule, rulers, resistivity departure curves[4] and data sheets. These materials make interpretation particularly inconvenient when analyzing a log at the well site, in a cold doghouse, at midnight.

The loganalyzer was designed to eliminate some of these inconveniences. It condenses basic equations, charts, a slide rule and a ruler into a compact, pocketsize calculator. At the same time it improves the accuracy and ease of reading results. No pocketsize slide rule could embrace all of the data required for all interpretation problems. This tool, however, contains facilities for solving the great majority of the quantitative relationships and log analysis problems.

A NEW SLIDE RULE is designed to assist in the rapid and accurate quantitative interpretation of electric logs. Utilization of the slide rule will permit determination of porosity, permeability and water saturation by the Tixier method plus porosity and water saturation by the Archie method.

Physical Description

The loganalyzer is built of durable vinylite plastic, is reinforced with nickel eyelets, weighs about two ounces and the dimensions are 3⅞ x 9 inches. The case, in light solid color, carries scales in black. The slide is white, vinylite plastic with scales printed in red and black for easy reading. General instructions for operation, with examples, are printed on the case.

Features of the loganalyzer:

- Eliminates cumberson charts and complicated data sheets.
- Eliminates laborious mathematical solutions for most problems.
- Rapidly obtains porosity by the Tixier method with great speed and accuracy.
- Obtains porosity by the Tixier method, automatically, for cementation factors of 2.0, 1.8 and 1.6.
- Instantly obtains percent water saturation by the Tixier method for electrochemical K coefficients of 70 and 90 or for Rmf/Rw direct. Graphical expressions would require a number of charts.
- Obtains, in one slide movement, either porosity, formation factor, or Ro/Rw for three common cementation factors, 2.0, 1.8, or 1.6. Any factor may be changed merely by moving the slide.
- Instantly obtains, in one slide movement, water saturation by the Archie method for the 2.0 or 1.8 root of Ro/Rt for clean and dirty formations.
- Instantly obtains permeability from the log basic resistivity gradient of Tixier[5] for API gravities 10 to 60° and for water densities of 1.0 and 1.1.
- Quantitative relationships are clarified. Complicated formulas are made visual.
- A millimeter scale is provided for accurate measurement of ohms and millivolts from any log. This is particularly useful in low resistivities.
- It is unnecessary to draw and project lines as in the common nomographic solutions.

Solution of Quantitative Relationships

The front face (Figure 1) of the loganalyzer allows the following rapid computations:

A. Top Slide—Connate water by the Tixier method from Rt(Rt/Rm), Ri(Ri/Rm) and S.P.

Starting with the true formation resistivity beyond the invaded zone, as obtained from a suitable long normal or lateral curve, and placing this by a simple movement of the top slide opposite the proper value of the invaded zone resistivity obtained from the short normal curve (both after correction), the connate water percentage can be read directly opposite the proper value of the static self

potential on the top scale. The ratios of these resistivity values to the mud resistivity, as obtained from the departure calculations, can be used directly if desired.

B. Top Slide—Connate water saturation by the Tixier method from Rt(Rt/Rm), Ri(Ri/Rm) and Rw(Rm/Rw).

The same computation as before can be made with the top slide if the salinity or the resistivity of the connate water and mud are known, instead of the S.P. value, through the use of an alternate scale provided on the loganalyzer.

The basic equations, as derived by Tixier,[1] for the above connate water calculations are:

$$S = \frac{Ri/Rt}{Rz/Rw}$$

in which:

$$Rz/Rw = \frac{Rm/Rw}{(1 - .075) + .075 \times Rm/Rw} = \frac{10^{SP/K}}{(1 - .075) + .075 \times 10^{SP/K}}$$

C. Bottom Slide—Porosity by the Tixier method from Rt/Rm, SP and S.

Starting again with a ratio of true formation resistivity to mud resistivity

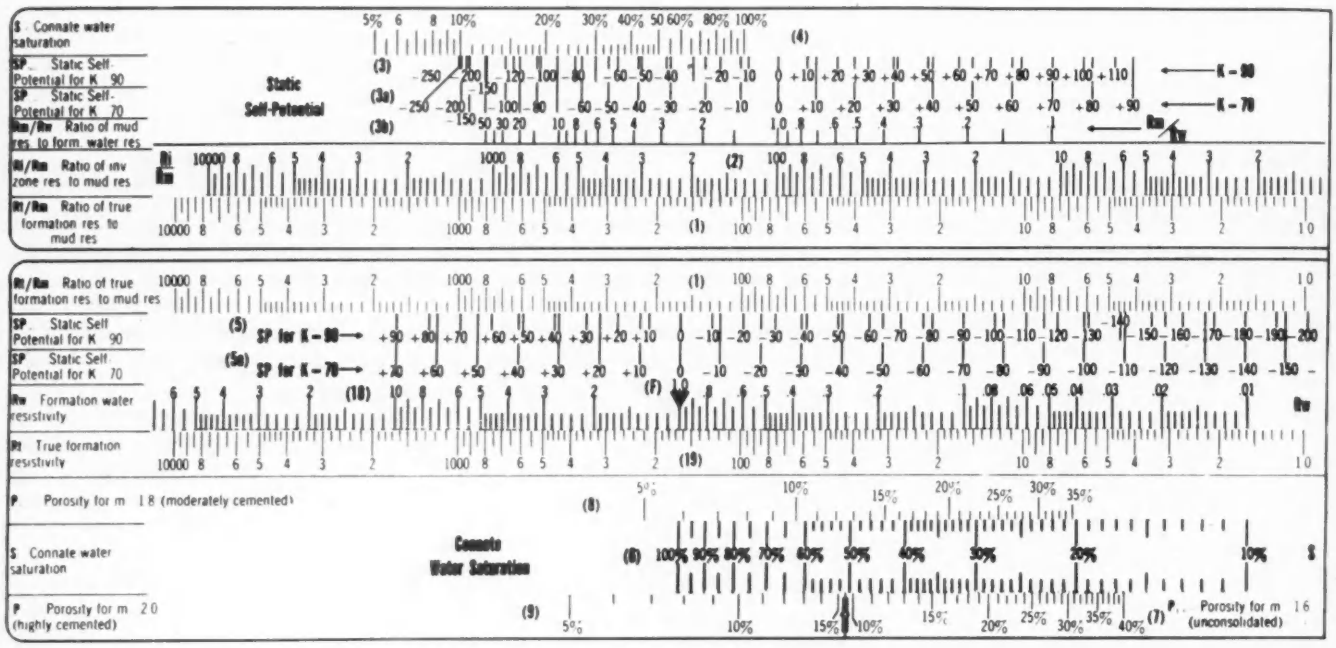
S - Connate water saturation
SP - Static Self-Potential for K - 90
SP - Static Self-Potential for K - 70
Rm/Rw - Ratio of mud res. to form. water res.
Ri/Rm - Ratio of inv. zone res. to mud res.
Rt/Rm - Ratio of true formation res. to mud res.
Static Self-Potential
K - 90
K - 70
Rt/Rm - Ratio of true formation res. to mud res.
SP - Static Self-Potential for K - 90
SP - Static Self-Potential for K - 70
SP for K - 90
SP for K - 70
Rw - Formation water resistivity
Rt - True formation resistivity
P - Porosity for m - 1.8 (moderately cemented)
S - Connate water saturation
Connate Water Saturation
P - Porosity for m - 2.0 (highly cemented)
P - Porosity for m - 1.6 (unconsolidated)

FIGURE 1. This is the front face of the slide rule which is designed to permit computation of connate water, connate water saturation and porosity by the Tixier method. In addition, it is possible to determine porosity of a water sand, formation factor from porosity and cementation factors and resistivity of water-bearing sections of a sand when connate water salinity is known.

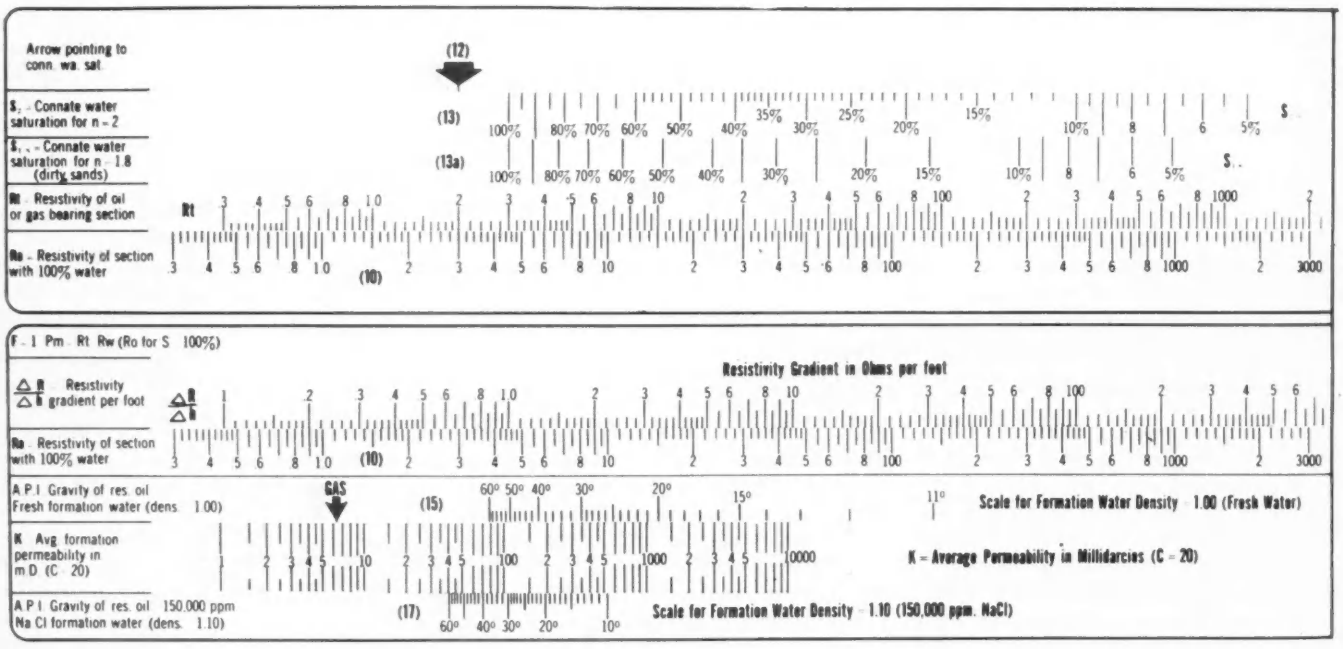
Arrow pointing to conn. wa. sat.
Sw - Connate water saturation for n - 2
Sw - Connate water saturation for n - 1.8 (dirty sands)
Rt - Resistivity of oil or gas bearing section
Ro - Resistivity of section with 100% water
F - 1 Pm - Rt Rw (Ro for S - 100%)
Resistivity Gradient in Ohms per foot
ΔR/Δh - Resistivity gradient per foot
Ro - Resistivity of section with 100% water
A.P.I. Gravity of res. oil Fresh formation water (dens. 1.00)
GAS
Scale for Formation Water Density - 1.00 (Fresh Water)
K - Avg. formation permeability in m.D. (C - 20)
K - Average Permeability in Millidarcies (C - 20)
A.P.I. Gravity of res. oil 150,000 ppm Na Cl formation water (dens. 1.10)
Scale for Formation Water Density - 1.10 (150,000 ppm. NaCl)

FIGURE 2. The back side of this slide rule is planned to allow calculation of connate water saturation by the Archie method and average permeability from the resistivity gradient by the Tixier method.

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and placing, through a single movement of the bottom slide, the proper value of this ratio opposite the self potential, porosity in percent can be read directly on one of the bottom scales, opposite the connate water percentage as determined above. Different scales are provided for unconsolidated, moderately cemented, and highly cemented formations. When the porosity is known from core analysis, the same method can be used in reverse to find the connate water saturation directly.

D. Bottom Slide—Porosity by the Tixier method from Rt,Rw, and S.

The same computation of porosity as above can be made with the bottom slide without the knowledge of self potential or mud resistivity, when the true formation resistivity and the water salinity or resistivity are known instead. Again, when the porosity is known from core analysis, the same method can bes used in reverse to find the connate water saturation directly as in independent check on the computation carried out with the top slide.

E. Bottom Slide—Porosity of a water sand from Ro/Rm and S.P.

Porosity of the water bearing portion of a sand, where the connate water saturation can be assumed to be 100 percent (which eliminates one of the unknowns), can be computed directly with the bottom slide, in a manner similar to (c) without first using the Top Slide.

F. Bottom Slide—Porosity of a water sand from Ro and Rw.

Porosity can also be computed directly with the bottom slide when the resistivity of a water bearing sand and the salinity or resistivity of its water are known, in a manner similar to D. when the porosity is known from core analysis, the inverse procedure will produce the water resistivity or the salinity.

G. Bottom Slide—Formation factor from porosity and cementation factor.

For a given porosity and cementation factor the formation factor can be read directly as the true resistivity of a 100 percent water saturated sand with connate water of one ohm-meter resistivity. The latter is indexed with an (F) on the sliderule.

H. Bottom Slide—Resistivity of water bearing section of a sand when connate water salinity is known.

By carrying the method of computation of G one step further, the Ro value (for use in the Archie calculation of connate water) can be determined quickly for a sand with known porosity and cementation factor, when the connate water salinity or resistivity are known.

Basic equations used in the above Archie and Tixier computations of the porosity are

$$P^{-M} = S^2 \times Rt/Rw = F$$

and, $Rt/Rw = Rt/Rm \times 10^{SP/K}$

The back face (Figure 2) of the loganalyzer allows the following rapid computations:

I. Top Slide—Connate water saturation by the Archie method from Ro and Rt.

When the electric log shows the water bearing portion of a uniform sand, together with the oil bearing section in which it is desired to compute the connate water saturation, the well-known Archie method can be used. This computation is based on the following formula:

$$S\% = 100 \times \sqrt[n]{Ro/Rt}$$

On the top slide, this computation can be carried out in one movement by placing the true resistivity of the oil bearing section opposite the value of the resistivity of the wet section and reading the connate water percentage directly on another scale. Two separate scales are provided, one for clean sands, the other for shaly and dirty sands.

J. Bottom Slide—Average permeability from the resistivity gradient by the Tixier method.

Tixier[5] developed the following relationship for the cases when a linear resistivity gradient in the transition zone is available:

$$K = C \times \left[\frac{2.3\ d}{dw - do}\right]^2$$ in which

K = Permeability in millidarcies

dw = Specific gravity of formation water

do = Specific gravity of reservoir oil

C = a constant which, according to Tixier, for the Mid-Continent fields appears to of the order of 20.

and where:

a = $\Delta R/\Delta H \times 1/Ro$ with
$\Delta R/\Delta H$ being the resistivity gradient per foot and
Ro being the resistivity of the water bearing section.

Combination of these two equations leads to:

$$K = 105.8 \times \left[\frac{\Delta R/\Delta H \times 1/Ro}{dw - do}\right]^2$$ millidarcies

This equation is the basis of the computation of permeability on the bottom side. The determination of permeability on the loganalyzer is reduced to the simple operation of placing the value of the resistivity per foot opposite the Ro value of the water bearing section and reading the average permeability directly opposite the API gravity of the reservoir oil. Two scales are provided, one for fresh water of specific gravity 1.0 and the other for salt water of specific gravity 1.10, salinity 150,000 parts per million NaCl. Interpolation for other salinities is possible. The specific gravity for free gas compared to water for average conditions was assumed to be of the order of 0.1.

The loganalyzer does not eliminate the necessity for correcting apparent resistivity values from normal and lateral resistivity curves into true resistivity values through the use of resistivity correction curves. Such corrections are of considerable magnitude in rocks of high resistivities. They are less severe in formations of moderate to low resistivities. Although resistivity correction curves must yet be available for many problems, the loganalyzer materially reduces the paraphernalia previously required.

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REFERENCES

[1] M. P. Tixier, "Electric Log Analysis in the Rocky Mountains," (API Drilling and Production Practice 1949, page 316).

[2] G. E. Archie, "The Electrical Resistivity Log as an Aid in Determining Some Reservoir Characteristics," (AIME Technical Publication No. 1422).

[3] G. E. Archie, "Electrical Resistivity an Aid to Core Analysis Interpretation," (A.A.P.G. Bulletin, Vol. 31, No. 2, February, 1947).

[4] Schlumberger Well Surveying Corporation, "Resistivity Departure Curves," (Document Number 3, 1949 Issue—Private Printing).

[5] M. P. Tixier, "Evaluation of Permeability from Electric-Log Resistivity Gradients," (The Oil and Gas Journal, June 16, 1949). «

ACKNOWLEDGMENTS

The idea for a quick calculator was discussed in a log interpretation school. J. J. Arps, manager of production research for The British-American Oil Producing Company, conceived a suitable design and executed the construction of the first loganalyzer, which was used for some time before modifications were introduced. Valuable suggestions were offered by logging company personnel, particularly by M. P. Tixier of Schlumberger Well Surveying Corporation. The J. B. Carroll Company of Chicago suggested invaluable technical improvements. Obviously, the loganalyzer solves basic relationships originally developed by G. E. Archie of Shell Oil Corporation and M. P. Tixier of Schlumberger.

Stability of Mud In High-Temperature Holes Shown by Surface Tests

By G. R. GRAY, A. C. CRAMER and K. K. LITMAN

Baroid Sales Division, National Lead Company

THIS ARTICLE describes a simple method of predicting the performance characteristics of lime base drilling fluid. An outstanding contribution to the technique of deep, high temperature well drilling, lime base muds sometimes assume a hard, dehydrated consistency which makes it difficult, if not impossible, to conduct bottom hole surveys or even run drill pipe.

WITHIN the last few years, drilling to 12,000 feet in Gulf Coast area has ceased to be unusual and wells are drilled to 15,000 feet with less difficulty than formerly attended the completion of 10,000-foot holes.

Improvements in drilling mud technology have contributed materially to the successful drilling of deep holes. With increase in depth has come the requirement of high weight mud with low viscosity, low gel and low filter loss. In deep holes the mud is subjected to conditions of temperature and pressure far removed from those under which the usual tests are made. It should not be surprising, then, that the standard tests may fail to indicate performance of the mud in a deep, high temperature hole, particularly after the mud has remained undisturbed for hours at temperatures as high as 325° F. and pressures approaching 10,000 pounds per square inch.

In the past five years, high-pH, lime-treated muds, in many instances containing starch, have been used almost exclusively in deep drilling in the Gulf Coast area. Such muds usually were quite stable, the desired properties being controlled easily while drilling thick beds of shale and salt-water-bearing sands. As depths became progressively greater, more instances were reported of difficulty in maintaining low viscosity and gels, particularly after the high pH mud had been used for a long time. Also, logging electrodes sometimes failed to reach bottom and, on going back in the hole with the drill pipe, no evidence of caving or bridging was found. These difficulties were met most frequently in wells having bottom-hole temperatures exceeding 250° F.

It was concluded that the unsatisfactory performance of the mud was due to changes which were brought about by the high temperature to which the mud was subjected in the deep hole. Laboratory tests showed that some of the muds which were difficult to control displayed a marked increase in viscosity and gel in the filter cell following a filtration test at 200° F. and 500 pounds per square inch, although the water loss was not abnormally high. This observation led to the introduction of a simple field test. A sample of mud was sealed in a pint jar and placed in the blow barrel of a steam rig. The sample was examined after several hours to determine what change had occurred. Other samples, given various chemical treatments, were aged at the same time. This simple test served as a satisfactory method of control on a number of wells before an instance was found in which the treatment indicated by the "blow-barrel test" failed to prevent the excessive thickening of the mud in the hole. Bottom-hole temperature in this well was about 300° F. A storage cell was made from a bull plug and a cap (similar to the cell shown on the left in Figure 1). Mud samples were

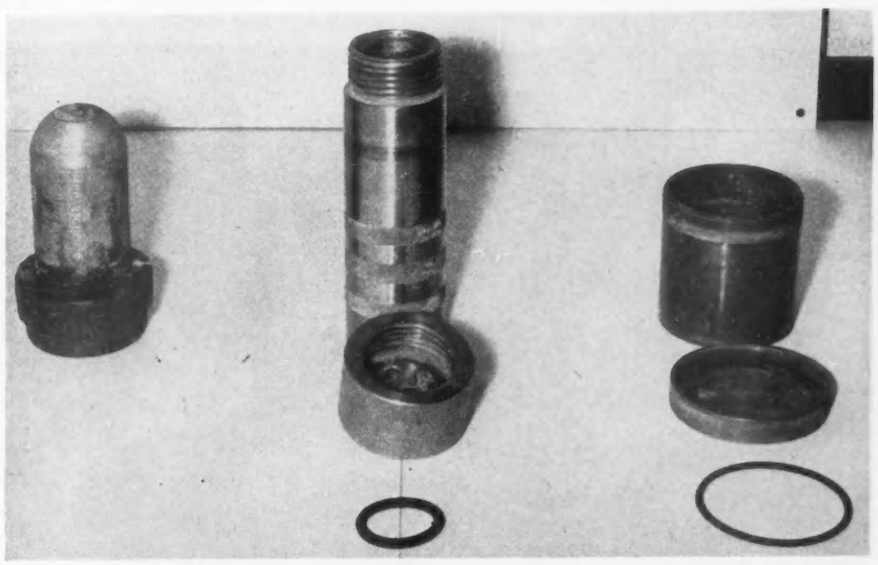

FIGURE 1. Cells designed for high temperature mud testing. The unit on the left consists of a bull and cap plug combination. The center unit, constructed of stainless steel, is tapped to allow the introduction of pressure. The unit on the right is fabricated of brass and, like the steel cell, is equipped with an 'O' ring seal.

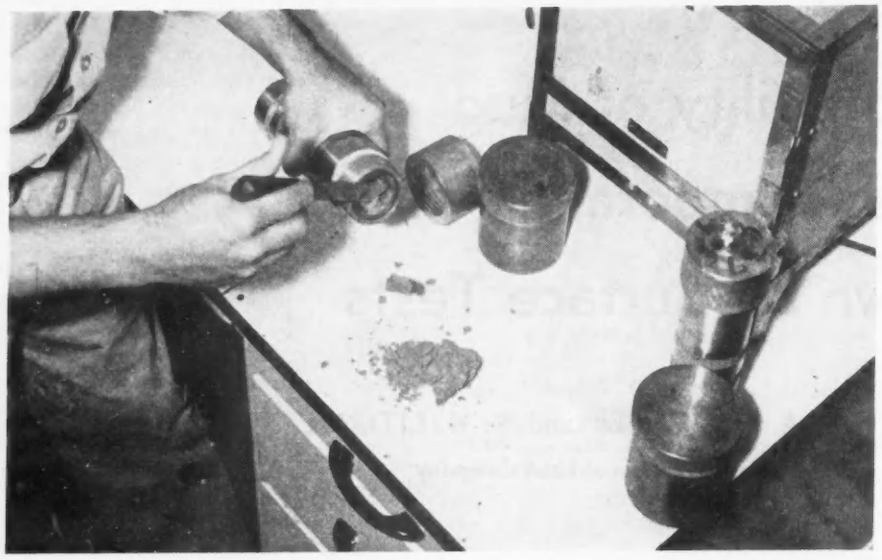

FIGURE 2. Illustrating original mud which set hard and appeared to be dehydrated although subsequent tests indicated the sample to have an equivalent water content.

FIGURE 3. A stage in the progressive treatment of the mud sample illustrating a plastic, easily deformed condition which would encourage a difficult pumping problem.

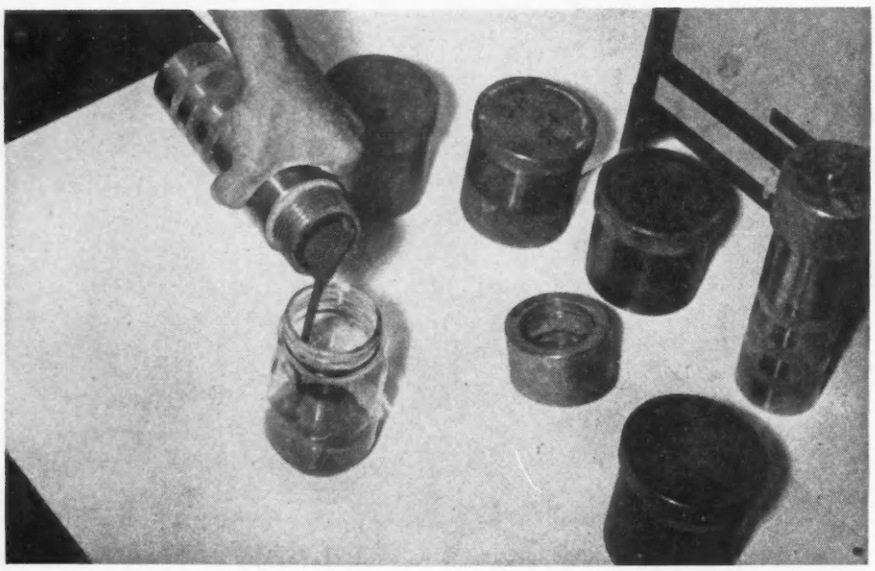

FIGURE 4. The result of the complete high temperature testing procedure showing a treated mud sample with desirable fluid characteristics.

heated for several hours in an oven at 300° F. The original mud became hard, and the treated sample which had remained fluid at 212° F. became plastic at 300° F.

Shortly thereafter, storage cells were built incorporating the "O"-ring seal. Figure 1 shows a stainless-steel storage cell (center) and a brass cell (right) fitted with "O"-ring seals. Such cells can be closed and opened by hand, whereas wrenches are required for the bull plugs. The stainless steel cell shown has openings in the cap for the application of pressure.

A number of tests at 1500 psi showed no discernible effect of pressure on thickening of muds at elevated temperatures and, consequently, pressure generally is neglected in field tests. That pressure is not a significant factor is evidenced by the favorable results in the hole which have been observed after treating the mud according to the indications of heat tests made at ordinary pressures.

The storage cells may be heated in an oven or in an oil bath. On a steam rig, a simple oil bath can be prepared by inserting a spiral of copper tubing into a bucket containing lubricating oil. The flow of steam through the tubing can be regulated to afford sufficient control of temperature. On power rigs, an electric oven, immersion heater or hot plate can be used to heat an oil bath. A stirrer for the oil bath is desirable but not essential.

Figures 2, 3 and 4 show mud samples being removed from the storage cells after being heated for 24 hours at 300° F. Figure 2 shows the original mud which had set hard and appeared to be dry, although subsequent determinations showed no difference in water content of the three samples. The treated mud in the second cell, Figure 3, was plastic, easily deformed, but excessive pump pressure would be required to lift such a mud from the bottom of a deep hole. The treated sample in the third cell, Figure 4, remained fluid and showed little increase in viscosity after the period of storage at 300° F.

Hundreds of tests in the laboratory, coupled with tests made in the field on numerous wells, afford evidence that high-temperature storage tests at the surface can be used to predict performance of the mud on standing in the hole for several days. The use of this method of testing makes possible the simultaneous evaluation of several treatments to overcome thickening. Periodic testing also affords a means of detecting changes in stability and remedial treatment can be started before the situation becomes critical.

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The Effect of Mud Filtrates and Mud Particles upon the Permeabilities of Cores

Part 2—CONCLUSION

By T. J. NOWAK and R. F. KRUEGER
Research Department, Union Oil Company of California, Wilmington, Calif.

THE SECOND and concluding part of this series deals with the effect of field mud particles on the oil permeability of inert cores as a result of static and dynamic mudding-off operations conducted at elevated temperature and pressure.

ARNQUIST[7] in 1937 and Beeson and Wright[8] recently have shown that apparently particles from drilling fluids do penetrate into the pores of water saturated cores, and the former author observed a considerable reduction in permeability to water of his test cores after such an invasion. In studies reported herein, consideration is given not only to evidence of particle invasion but also to filtrate losses and deplastering following mudding-off.

In an effort to simulate conditions existing in the well bore, that is, high temperature and high pressure and dynamic and static drilling fluid deposition, it has been necessary to design and build new equipment. For the dynamic tests, circulation of drilling fluid was combined with jetting and scraping of a core face in a manner which simulated mud and bit action during actual drilling operations. Alundum cores have been used in order to divorce particle effects from clay swelling effects.

Apparatus and Experimental Procedures

Circulation System: The dynamic mudding-off system shown in Figure 6 was designed to permit tests on small scale specimens under various reservoir conditions. However, in the present tests there was maintained an average temperature of 175° F. in the fluid system and an average pressure drop of 1000 pounds per square inch across the core specimen. Pressure surges of ± 200 pounds per square inch were present in all runs. A steam-operated pump was used to circulate the drilling fluids through the system. Because of the abrasive nature of the fluids, normal back-pressure devices could not be used and the back-pressure was maintained on the system with a choke made of a four-foot length of thick wall tubing of small inside diameter, the dimensions being determined by the fluid characteristics and by the pressures desired. As a safety precaution the choke was replaced after four to five hours of operation.

The mud temperature was thermostatically controlled inside the mud sump which contained both water and steam coils and an agitator. With most drilling fluids the steam was necessary only to reach operating temperatures rapidly; thereafter, frictional resistance in the circulating system was sufficient to keep the fluid hot while the temperature was regulated by thermostatically controlled cooling water. Using this system, temperatures were maintained within ±1° F., at the inlet to the test cell.

Mudding-Off Cell: The mudding-off cell was a 26-inch length of thick wall 4½-inch outside diameter Shelby tubing, plastic coated internally to prevent corrosion, and containing six stainless steel ports for mounting the test specimens. The stainless steel reciprocator bar contained six-spring loaded scrapers and six jets fitted inside the mudding-off cell so that the bar type scraper bore against the face of the core specimen. The jet hole, located about one-eighth-inch above the scraper blade, was directed so that the jetted fluid would impinge normal to the core face. Figure 7 shows a cross-sectional view of the mounted core specimen and scraper-jet alignment. All pressure closures were designed with "O" ring seals. The bottom of the reciprocator was linked to an eccentric cam driven by a gear reduction motor. By this means, a five-eighths-inch stroke was imparted to the scrapers across the face of the specimen at a rate of ten strokes per minute.

Referring again to Figure 6, it is seen that two operations can be performed on the test core: First, severe conditions approximating bit penetration and jetting of the drilling fluid through the bit can be simulated by introducing the fluid into the top of the reciprocator (follow solid arrow on diagram), the mud stream jetting directly onto the core face while the scrapers continually scrape off any cake formed; second, circulation past the formation above the bit can be approximated by introducing the fluid into the bottom of the cell (follow dotted arrow) with the inlet to the reciprocator closed and the reciprocator itself motionless, thus merely circulating tangential to the core face.

Papers by Bielstein and Cannon[9] and by Nolly, Cannon and Ragland[10] indicate optimum drilling practice requires drilling fluid nozzle velocities of 170 to 245 feet per second and annular return velocities of 200 feet per minute with 54 feet per minute being a lower limit. A recent paper by Williams and Bruce[11] indicates annular velocities of 125 feet per minute is an optimum value. Although the equipment used in the present studies was designed to attain these velocities, the initial tests were performed at lower values because of the extreme erosion in even one-hour tests on the cores of high permeability. Thus, tests reported in this paper were performed at average jet velocities of 125 feet

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per second and an annular circulation velocity of 100 feet per minute. Total drilling fluid volume in the system was approximately 75 gallons, thus minimizing changes in fluid characteristics resulting from filtrate or particle losses.

Test Cores: The test specimens consisted of four grades of one-inch diameter Alundum rod cut into one-inch lengths, the effective oil permeability ranges being 14-23, 50-57, 105-115, and 227 to 248 millidarcys. Synthetic cores were chosen because of their chemical inertness, since it was the purpose of this phase of the work to isolate, if possible, effects of mud particles from the effects of mud filtrate interaction with the formation. An additional advantage is that these synthetic cores appear to have water retention curves and relative permeability curves similar to those of oil field cores.[4, 12]

Preparation of Cores: The Alundum cores were leached with hydrochloric acid and distilled water to remove all traces of iron, then extracted with toluene and dioxane, dried and mounted in high temperature resistant Lucite by the method of Showalter.[13] The cores were then evacuated and saturated with three percent sodium chloride solution. Interstitial water saturation was then attained dynamically as follows: Seven and one-half liters of oil (42° API filtered kerosine) were flowed through the core at 1000 pounds per square inch pressure drop. The permeability to oil was determined, following which an additional 7½ liters of oil was flowed through the core at 1000 pounds per square inch. A second determination of permeability indicated little or, as in the majority of cases, no increase in oil permeability. Therefore, it was assumed interstitial water saturation had been reached. Values for the effective permeability to oil were found to compare favorably with those determined on similar cores desaturated to the interstitial water content by the capillary desaturation method. The cores were then ready for mounting in the mudding-off cell.

TABLE 1
Properties of Field Drilling Fluids Used in Dynamic and Static Mudding-Off Tests.

Property	Temp. °F.	Type of Drilling Fluid: Clay-Water Base	Oil Base	Emulsion
Density, pcf	78	68	67	66
Marsh Funnel Viscosity (Sec.)	78	55	316	37
Shear, lb. 100 ft.^{2} Initial	78	5	0	0
10 minutes	78	32	0	0
Fluid Loss (API) ml. (corrected) 15 minutes	175	8.3	0	7.5
60 minutes	175	16.4	0.35	14.9

Properties of Drilling Fluids Tested: Three types of drilling fluids were used for comparative purposes, an emulsion, a clay-water base, and an oil base. These fluids were obtained from wells being drilled locally and were considered typical field muds. The properties of each of these fluids were determined by standard API test methods and are listed in Table 1.

Test Procedure: The general test procedure was to mount four cores, one from each permeability range, in the mudding-off cell as the drilling fluid was being circulated through the by-pass line and heating up to temperature. Pipettes were attached to the outflow end of the cores (Figure 6). Upon introducing the fluid to the test cell the cumulative volume of filtrate was read on the pipettes at time intervals of 1, 2, 5, 10, 30, 45 and 60-minutes. At the end of 60 minutes, the test was terminated. Each drilling fluid was tested while circulating only and during jetting and scraping combined with circulation.

Following this the cores were removed from the test cell, assembled between Lucite end caps, and their permeability to oil determined without disturbing any filter cake. The direction of flow was counter to that of filtrate flow during mudding-off. Next, oil was backflowed through the cores using a pressure drop of 50 pounds per square inch. Permeabilities to oil were run at intervals during the backflow process to determine the permeability recovery curves.

Early in the deplastering tests after the mud cake had started to break away from the face of the core, it was observed that an emulsion was produced from the cores which had been mudded-off with both clay-water base and emulsion muds. Upon releasing the deplastering pressure to run a permeability, this emulsion was imbibed into the core. This phenomenon tended to produce erratic recovery curves, depending on the amount of emulsion breaking away from the core face during deplastering and upon the amount imbibed into the core upon releasing the back-pressure.

In addition to the dynamic tests, comparative static tests at 1000 pounds per square inch and 150° F. were run with each of the three drilling

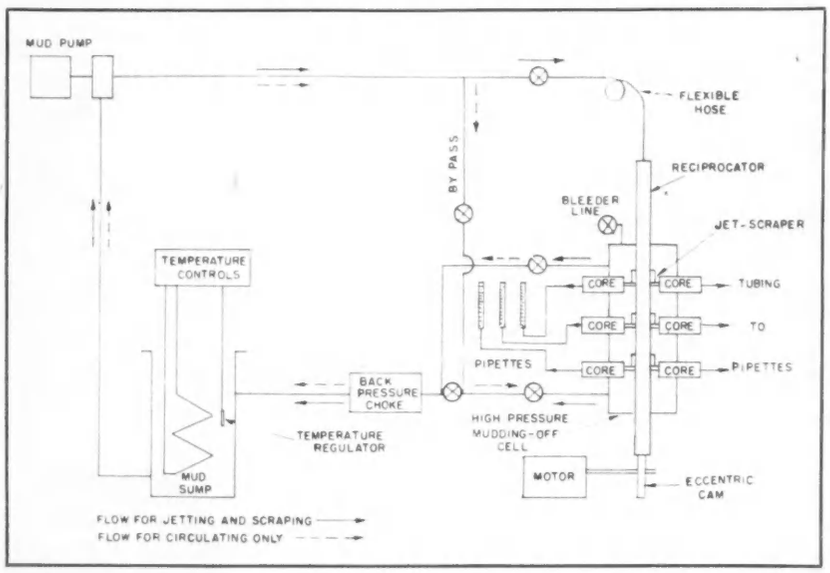


FIGURE 6. Flow diagram of dynamic mudding-off system.

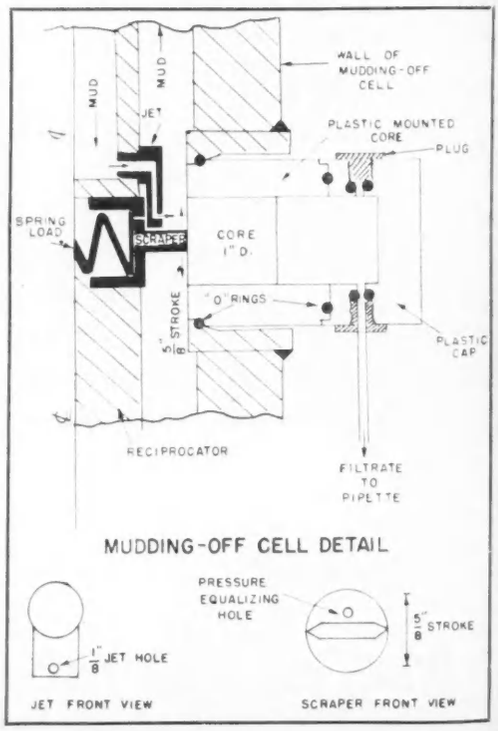
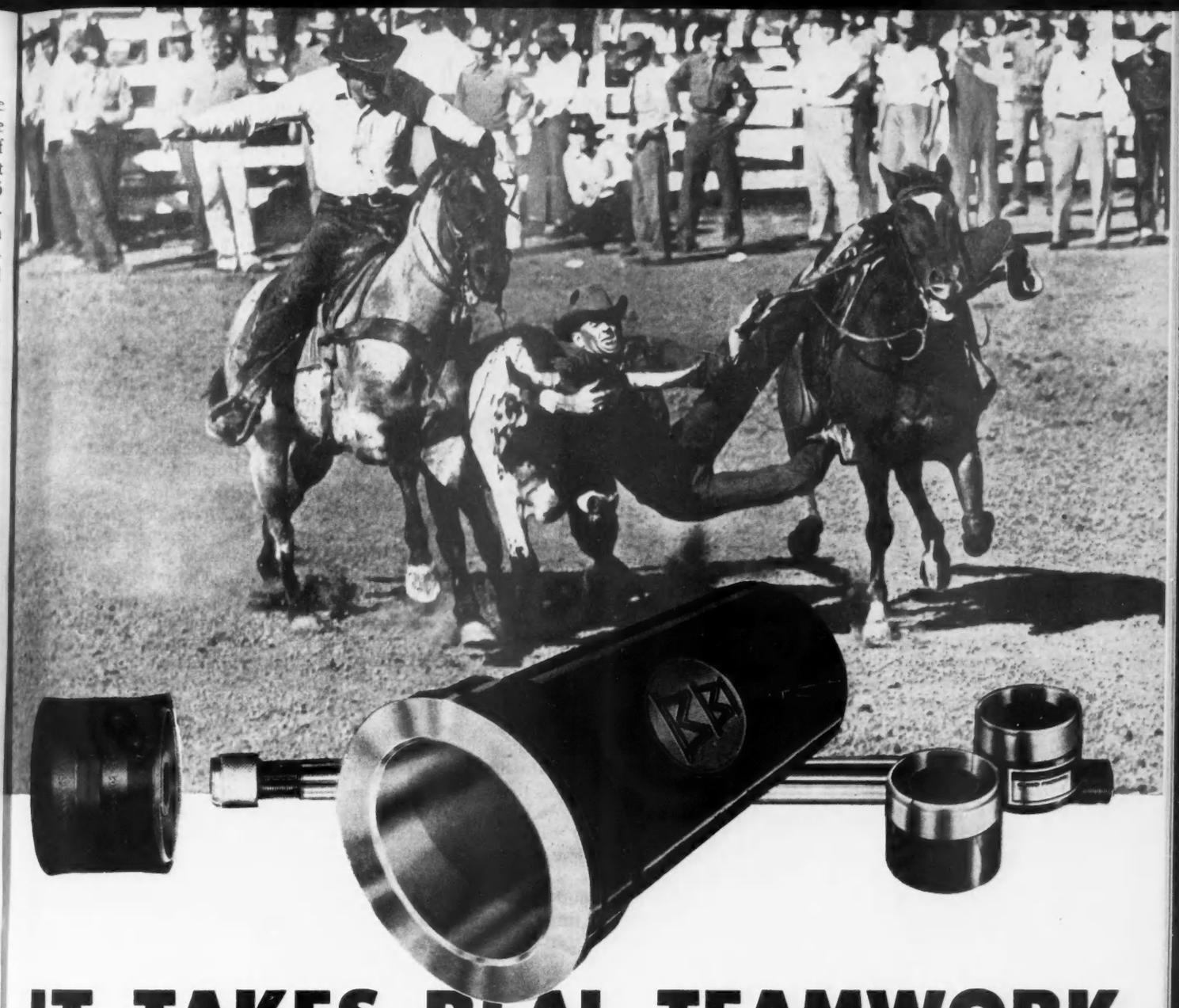


FIGURE 7 (right). Section view of mudding-off cell detail.



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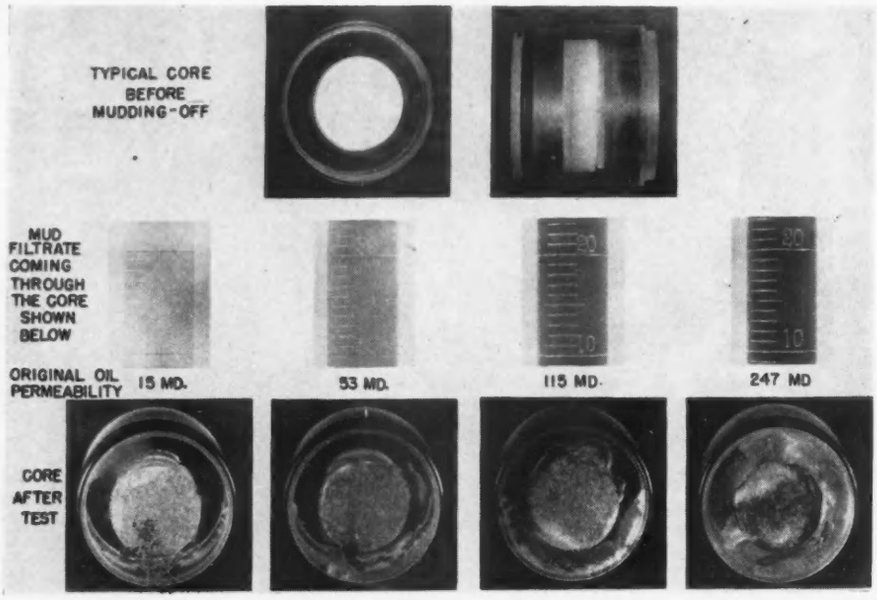

FIGURE 8. Cores and filtrates from dynamic mudding-off test with clay-water base mud (jetting and scraping).

fluids using cores from the Gatchell zone at Northeast Coalinga. The permeabilities of these cores ranged from 740 to 900 millidarcys. A temperature lower than in the dynamic tests was used since these cores had previously been mounted in low temperature resistant Lucite.

As might be expected, the more severe test resulted from the use of jetting and scraping. In general, the cores of high permeability proved the most friable and the most easily eroded by scraping and jetting. Figure 8 shows photographs of a Lucite mounted core before a test and after completion of a one-hour test with jetting and scraping in clay-water base mud. On the eroded cores it was necessary to make approximate length corrections in calculating permeabilities obtained during deplastering tests.

For both clay-water base mud and emulsion mud in the jetting-scraping tests, the filtrate emerging from the core was discolored, the degree of discoloration increasing regularly from the cores of low permeability (Figure 8). Unfortunately, the tests could not be run long enough to determine whether or not the filtrates cleared up with time. Electron micrographs indicated that the dimensions of the particles from these filtrates varied from a small fraction of a micron to over a micron and, in general, particle concentrations corresponded with the degree of discoloration. A typical electron micrograph of the particles from the clay-water base mud filtrate which passed through a 115-md. core during the jetting-scraping test is shown in Figure 9. The approximate average pore diameter of the core is indicated for comparative purposes. The presence of mud particles in the filtrates from the circulating tests was determined in a similar manner. However, their concentration was very small.

Figures 10, 11 and 12 show filtrate loss curves for clay-water base, oil base, and emulsion drilling fluids, respectively, and Figure 13 compares the filtrate losses of these fluids for cores which have oil permeabilities from 225 to 250 millidarcys. Several points of interest are immediately obvious. First, for the clay-water base and emulsion muds the filtrate losses are about ten times greater during jetting-scraping tests than during circulation tests while for oil base mud the difference is small. Second, the clay-water base and the emulsion muds have very similar and high filtrate losses while oil base mud filtrate losses are smaller by a factor of approximately ten. Third, although the filtrate loss curves for a given drilling fluid lie close together for cores of different permeabilities, their distribution does not appear to be random

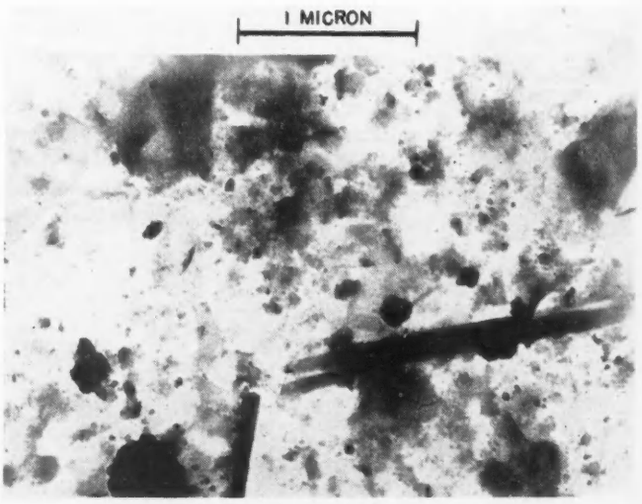

FIGURE 9. Electron micrograph of particles from clay-water base mud filtrate produced through a 115 md. oil permeability core. (Jetting and scraping.) Approximate average pore diameter of core: 20 micron.

experimental error, but appears to have a definite trend with cores of low permability exhibiting higher filtrate losses than those of high permeability. This trend appears for both jetting-scraping tests and for circulation tests.

In order to eliminate the possibility that this trend may have been due to a peculiarity in the test cell and the particular location of the test core, the oil base drilling fluid was used for a jetting-scraping check run, in which the locations of cores of different permeabilities were changed from those of the preceding run. The cores of low permeability still yielded the highest filtrate losses. Furthermore, the small differences in dimensions of the cores were not of sufficient magnitude to account for the difference in filtrate losses for different cores.

Williams and Cannon[14] have inferred from their work on the plastering behavior of drilling fluids that the filtration properties of such fluids are determined primarily by the amount and nature of the solids present, thus implying that rock permeability has little effect upon plastering. Byck[15] concludes from his experimental data that fluid losses depend only upon the properties of the drilling fluid and hence are independent of formation permeability. The data presented in Figures 10 to 13 apparently do not confirm these conclusions.

Although there is not enough information available relative to these other investigations to explain the apparent discrepancy in their results and those of the authors, it is believed that the data from the filtrate curves obtained from the present dynamic mudding-off tests can be explained on the basis of information common in the filtration industry where it is generally recognized that the more permeable filtering medium does not always permit the greatest flow rate when filtering a given suspension of

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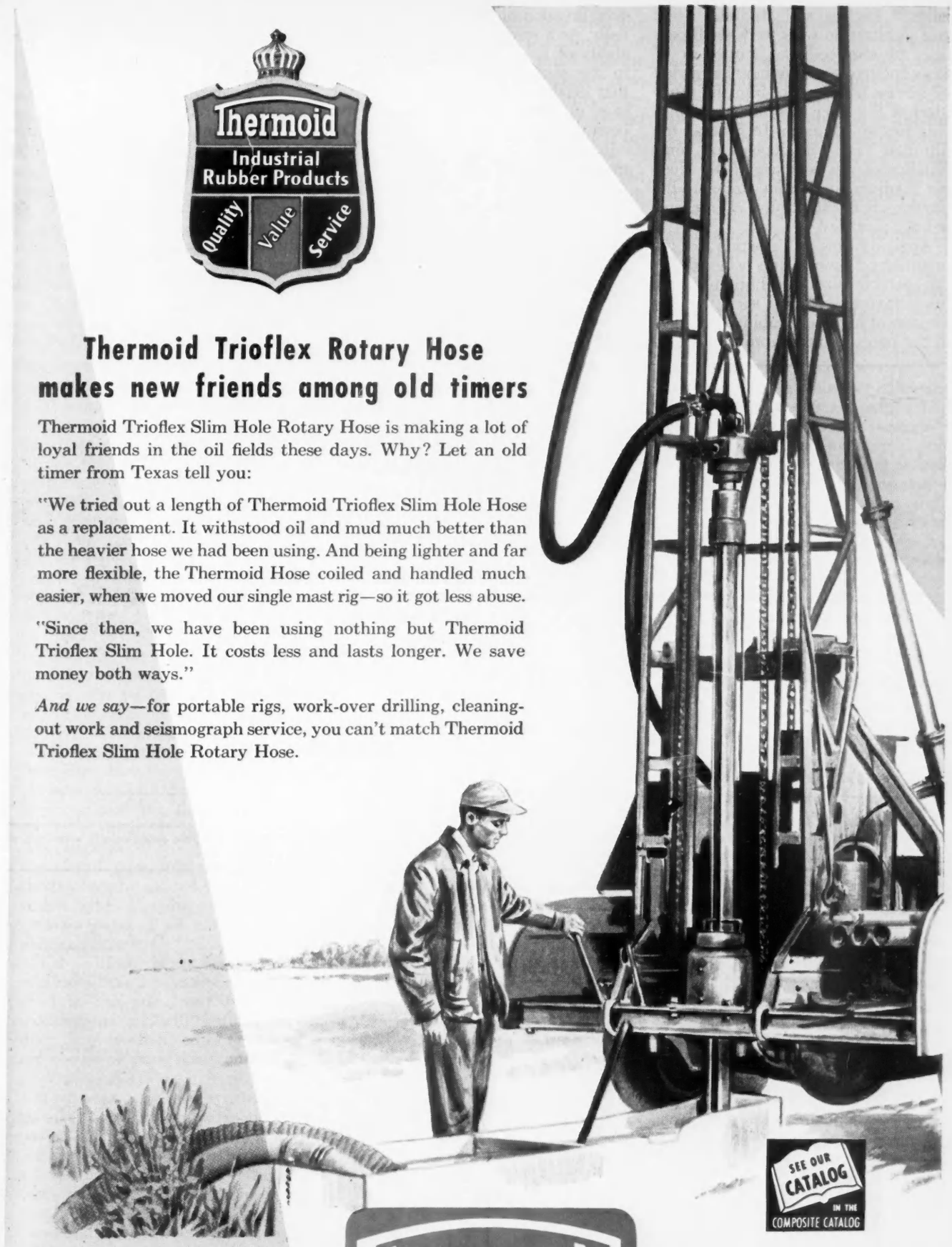

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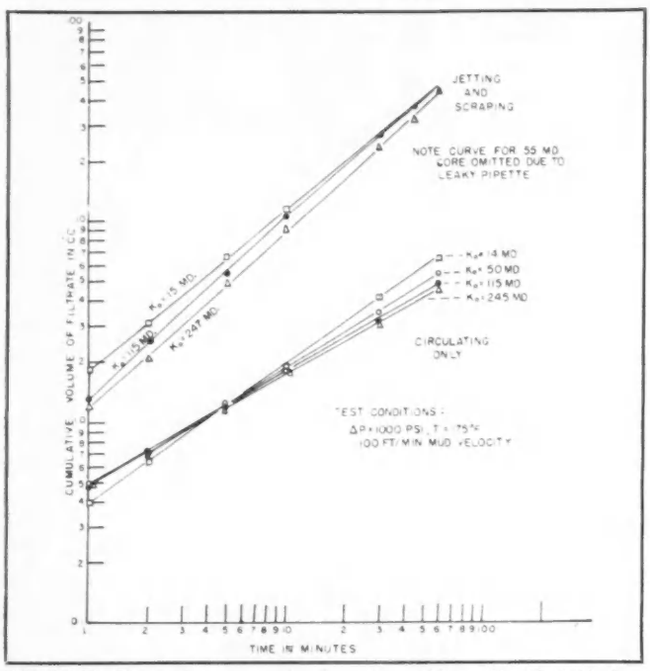
solids.[16] Dickey and Bryden[17] state that in filtration work very small particles of semi-colloidal nature or of weak enough structure may be carried by stream flow impact into the interstices of the filter medium, thus stopping further filtration. In general, the filtration rate will depend on some function of the pore size of the filtering medium and grain size and the physico-chemical nature of the suspended particles.

Applying this information to the mudding-off process, it is believed that the particle size distribution in the muds investigated was such that for the core of high permeability, plugging of the pores resulted from a relatively deep invasion of particles, at least initially. As a result, the effective permeability of the plugged core decreased to the same order of magnitude as that of the mud cake, which, in the case of jetting-scraping, must have been destroyed and re-formed repeatedly. Therefore, the resistance of the mud cake alone was no longer the controlling factor in the filtration. In this case the filtration rate would depend on the series permeability of mud cake and plugged core. Particle invasion and plugging are borne out by several observations: (1) darkening of the core to varying depths, depending upon type of drilling fluid and core permeability was observable through the Lucite sheath; (2) presence of mud particles in the filtrate was detected (Figure 9); and, (3) later discussion of results from deplastering tests will indicate, in some cases, an ultimate recovery of but 65 percent to 90 percent of the original permeability of oil. Some support for this hypothesis is presented by Beeson and Wright,[7] who indicate that appreciable reductions in mud loss to the formation and, to a lesser extent, in filtrate losses can be achieved by additives of the proper particle size to reduce particle invasion. Arnquist[8] has also reported reductions up to 90 percent in water permeability for some water saturated cores mudded-off with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CUMULATIVE VOLUME OF FILTRATE IN CC
TIME IN MINUTES

FIGURE 10. Filtrate loss curves for dynamic mudding-off with field clay-water base mud.

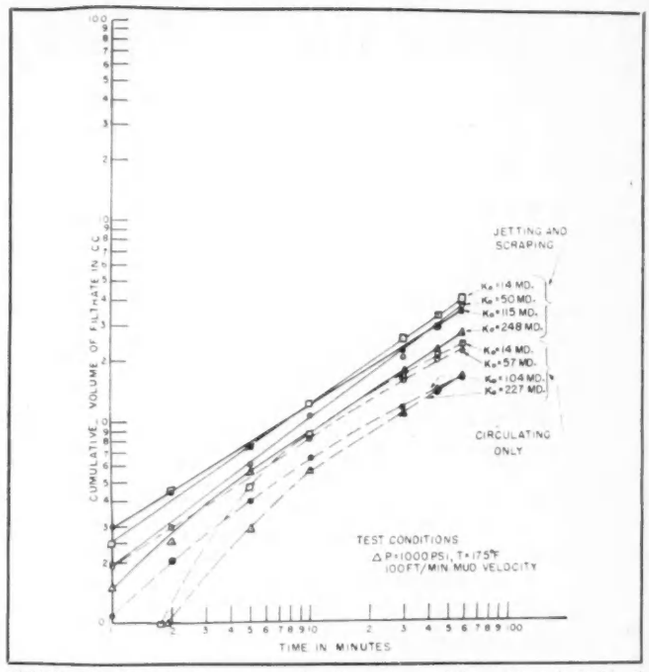

FIGURE 11. Filtrate loss curves for dynamic mudding-off with field oil base mud.

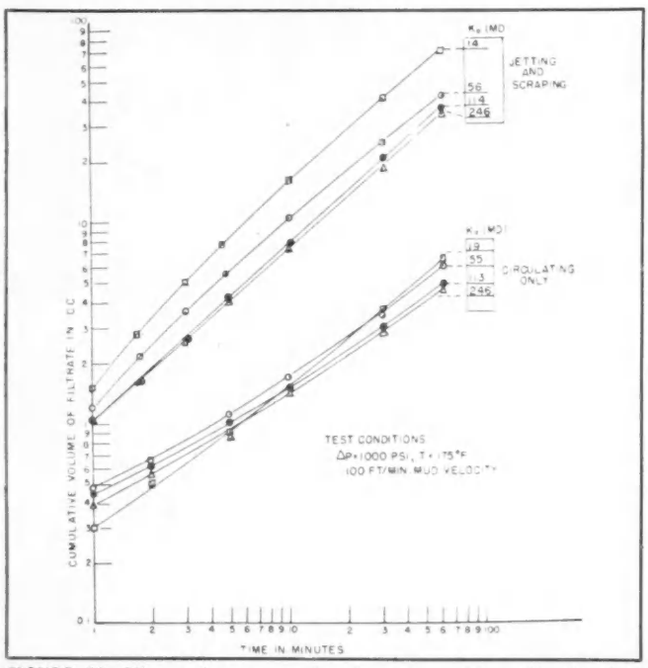

FIGURE 12. Filtrate loss curves for dynamic mudding-off with field emulsion mud.

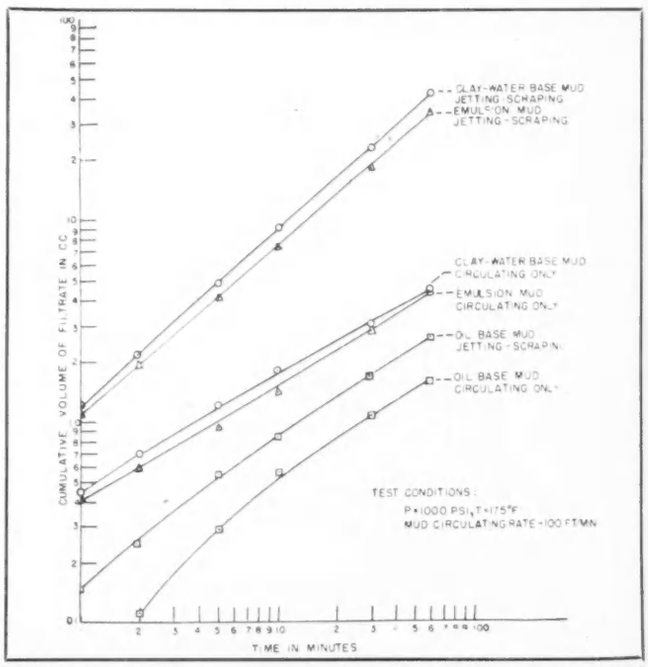

FIGURE 13. Filtrate loss curves for dynamic mudding-off with typical field muds for cores with oil permeability = 225-250 md.

drilling fluid. He observed also that the water permeability in these cores was not a simple, unique property of the cores but depended upon the distribution of the solid particles in the pore spaces.

Based on the results of the dynamic mudding-off tests and the hypothesis presented to explain them, it appears that filtrate loss from a drilling fluid is not completely independent of formation permeability. It is believed that filtrate losses are not a unique function of permeability but will depend upon the pore size distribution of the medium and the size distribution of physico-chemical nature of the particles in the drilling fluid as well. Hence, three general results may be postulated: (1) if particle size in the mud is such that relatively deep particle invasion of a formation of high permeability results in plugging, the filtrate loss may be lower in a more permeable formation than in a less permeable formation whose smaller pore size prevents particle invasion; (2) if the particle size distribution in the mud is such that good bridging occurs on formations of all permeabilities, the filtrate loss will be essentially independent of rock permeability; and, (3) if the particle size distribution in the mud is such that a relatively permeable cake is formed, and yet the particle distribution prevents appreciable particle invasion, the filtrate loss will be directly proportional to the rock permeability. Of these three possibilities it appears that the first two will be the more likely to occur and the third rather rare. As an example, it appears that the steep slope in all circulation tests with the 15-md. core indicates little interstitial plugging caused by particle invasion while plugging of varying degree occurred in all cores of higher permeability.

The evidence is not conclusive yet, of course, that the synthetic cores used react in the same way to dynamic mudding-off as will natural cores, since these synthetic cores have a narrow range of pore sizes compared to most natural cores. It is not certain also whether or not the synthetic core matrices are comparable in their behavior to natural cores.

Figure 14 shows the filtrate loss curves from static mudding-off tests of cores from the Gatchell zone in the Northeast Coalinga field. It will be noted that under static conditions at 1000 pounds per square inch pressure drop and 150° F. temperature, filtrate losses for all muds are low and comparable with the losses observed in the circulating tests, but a reversal from the dynamic tests is noted in that the clay-water base mud shows less filtrate loss than the oil base mud. While the number of static tests run was too small and the number of variables was too great to permit anything but conjecture, it appears that this reversal may be explained on the basis of the particle invasion hypothesis presented above.

Observations of the removal of mud cake by the backflow of oil through cores used in plastering tests showed an immediate disintegration of surface cake on cores taken from tests with oil base drilling fluid, whereas for the other drilling fluids the mud cake started to break off in a patchwise fashion only after 100 or more pore volumes of oil had been backflowed. It is believed that the disruption of the filter cake determines to some extent the rate of recovery of permeability to oil for mudded-off cores. The entire history of permeability recovery during the deplastering of cores is shown for both the circulating tests, Figure 15, and for the jetting-scraping tests, Figure 16. Of immediate interest is the rapid early recovery of the permeability to oil following mudding-off with oil base drilling fluid. The permeability immediately after mudding-off was obtained, in general at pressure drops of about one to two psi across the core with less than one pore volume (3.5 to 4.5-ml.) of oil throughput and yet even for the severe test of jetting and scraping (Figure 16) oil base mud showed initial permeability recoveries from 25 to 50 percent of the original oil permeability. On the other hand, initial recovery of oil permeability for clay-water base mud was less than 0.1 percent and for the emulsion mud varied from 0.1 to 7 percent. In the circulation tests there was better initial recovery of permeability in all cases except for the test with clay-water base mud, in which case the recovery remained less than 0.1 percent.

An insufficient number of drilling fluids have been tested to make any truly valid comparisons of their relative effects on cores. However, a few trends and generalizations may be noted. In general, recovery of oil permeability was the most rapid for oil base drilling fluid but ultimate recoveries were of similar value for all three muds. A second noticeable trend is that core of low original oil permeability recovered faster for a given number of pores volumes backflowed than did cores of high permeability. This does not, however, necessarily mean that cores of low original permeability will recover faster from the standpoint of time. It will also be noted that in most instances a backflow of 5000-pore volumes of oil was sufficient to produce oil permeabilities within a few percent of the expected (extrapolated) ultimate percent recovery of oil permeability. In a number of instances from 10,000 to 20,000-pore volumes of oil were backflowed through the core, and ultimate pressure drops as high as 1000 psi were used to define the general hyperbolic nature of the permeability recovery curves and to indicate the small additional permeability to oil to be gained above 5000-pore volumes throughput. In general, sufficient oil was backflowed through all cores to assure that the asymptotic portion of the recovery curve had been reached.

The data from the circulation tests indicate close to 100 percent permeability recovery for the synthetic cores and for the drilling fluids used, indicating that permanent damage by particle plugging is quite small for these conditions. However, curves for the jetting-scraping tests indicate some permanent plugging from particle invasion into cores of high permeability.

Recovery tests for the statically mudded-off cores were run over a limited range and in general showed similar trends to those obtained in the circulating tests.

Although no mention has been made of the possibility of fluid blocking as compared to particle plugging, it is apparent that in the early stages of deplastering both effects will con-

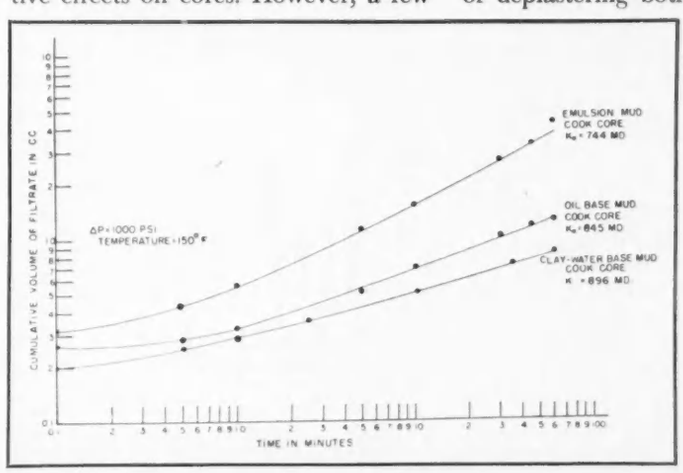

FIGURE 14. Filtrate loss curves for static mudding-off of cook cores with field muds.

tribute to the slow recovery of oil permeability, particularly for cores mudded-off with clay-water base and emulsion muds. However, as the backflow of oil continues, the relative effect of fluid blocking will decrease. No measurements of fluid saturations in the cores before and after mudding-off have been made; however, since greater volumes of oil were backflowed during the deplastering tests than during dynamic desaturations of the cores to the interstitial water content, it is believed that in these tests the effect of fluid blocking upon ultimate recovery of permeability to oil has been of less importance than particle plugging.

In general, the extrapolation of the deplastering results to field practice is necessarily tentative because of the preliminary nature of the work and the limited number of tests performed. It appears that the rate of permeability recovery after mudding-off is likely to be more important from the standpoint of time than from the standpoint of the number of pore volumes of oil backflowed. On this basis it appears that completion of a well with oil base mud could result in more production than would be obtained from one completed with either clay-water base or emulsion mud because of the much higher initial permeability after mudding-off and the more rapid early recovery of permeability.

Conclusions

Laboratory data in Part 1 have indicated the folowing effects of aqueous solutions and field mud filtrates upon the effective oil permeabilities of water sensitive sands:

- Fresh water and filtrates from fresh water-base muds significantly reduce the effective oil permeabilities of the cores.
- Within the limits of concentrations investigated the polyvalent salts (e.g. calcium chloride) in aqueous solutions are more effective than the solutions of monovalent (e.g. sodium chloride) salts in preventing permeability impairment of the cores.
- Filtrates from saline muds cause little permanent damage, and in some instances, produce improvement on the effective oil permeabilities of the cores.
- Oil base mud filtrate has essentially no effect on the effective oil permeabilities of the cores.

A test, based on the interaction of mud filtrates with sodium clay, has been developed to show the effect of the filtrate upon the oil permeabilities of water sensitive cores.

In Part 2 preliminary tests on Alundum cores mudded-off at high temperature and high pressure have provided several interesting observations and trends:

- Particles have been observed to penetrate into and through a test core of Alundum and plugging caused by mud particle invasion is indicated in deplastering tests.
- During deplastering tests on clay-water base and emulsion muds, emulsions are produced from the cores.
- Filtrate loss curves for each of three field drilling fluids, clay-water base, oil base, and emulsion base, have indicated from tests on four synthetic cores whose permeabilities ranged from 14 to 248-md. that there is a dependence of filtrate loss upon the permeability of the formation. This result can apparently be explained by particle invasion into the core. In these particular tests low permeability cores have shown filtrate losses higher than those for high permeability cores.
- Deplastering tests on the synthetic cores mudded-off under jetting and scraping conditions indicate some permanent permeability impairment of 20 to 35 percent in cores of high permeability for each of the three drilling fluids tested. However, there appears to be no permanent permeability impairment for water insensitive cores of low original oil permeability. The same tests on cores mudded-off under circulating conditions indicate almost complete recovery of original oil permeability upon backflow for all muds and for the whole permeability range. However, it may be inferred that, in practice, at least for the clay-water base and emulsion muds, a significant length of time would be required for such restoration to take place.
- A large number of pore volumes, in general of the order of 5000, must be backflowed to accomplish restoration of permeability to a value approaching the original.
- Oil base drilling fluid shows very rapid recovery of oil permeability during deplastering compared to clay-water base and emulsion muds but the ultimate recovery of all three is approximately the same. This rapid early recovery of oil permeability for inert cores tested with oil base drilling fluid may be significant in that it appears to indicate that more overall production could be obtained from water insensitive formations drilled with oil base mud than from those drilled with clay-water base or emulsion muds.

In general, the data presented in this report appear to indicate that greater impairment of permeability to oil may result from the interaction of fluids with water sensitive cores than from mud particle invasion into the interstices of inert cores.

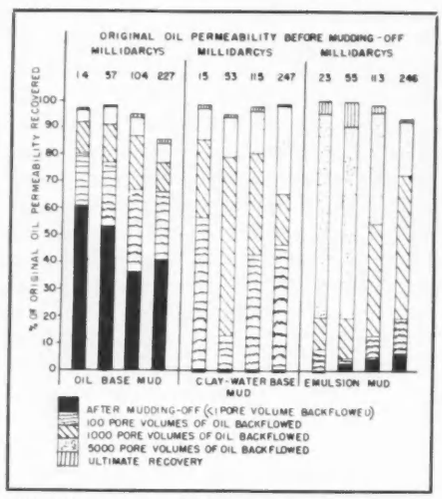

FIGURE 15. Permeability recovery after dynamic mudding-off with circulation only.

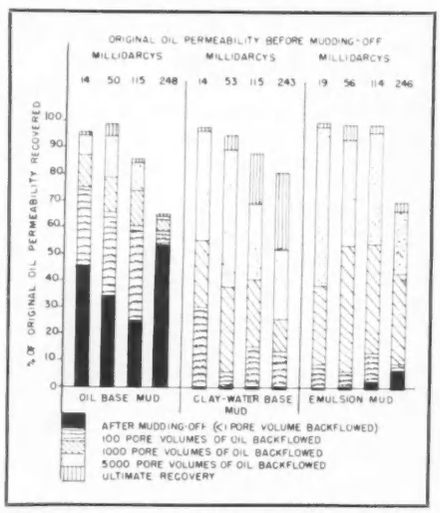

FIGURE 16. Permeability recovery after dynamic mudding-off with jetting and scraping.

ACKNOWLEDGEMENTS

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BIBLIOGRAPHY

[7] Beeson, C. M. and Wright, C. C., "Mud Loss to Formation Pores," AIME, Los Angeles Meeting of Petroleum Branch, October 12-13, 1950.

[8] Arnquist, W. N., "Note on the Filtering Action of Porous Media," *Journal of Applied Physics*, 8, 363, (1937).

[9] Bielstein, W. J., and Cannon, G. E., "Factors Affecting Penetration Rate of Rock Bits," *World Oil*, May, 1950, and June, 1950.

[10] Nolley, J. P., Cannon, G. E., and Ragland, D., "The Relation of Nozzle Fluid Velocity to Rate of Penetration with Drag-Type Rotary Bits," *Drilling and Production Practice*, 22-42, (1948).

[11] Williams, C. E., Jr., and Bruce, G. H., "Carrying Capacity of Drilling Muds," AIME, New Orleans Meeting of Petroleum Branch, October 4-5-6, 1950.

[12] Geffen, I. M., Owens, W. W., Parrish, D. R., and Morse, R. A., "Experimental Investigation of Factors Affecting Laboratory Relative Permeability Measurements," AIME, New Orleans Meeting of Petroleum Branch, October 4-5-6, 1950.

[13] Showalter, W. E., "Mounting Core Analysis Specimens in Thermo-plastics," AIME, Vol. II, November 12, December, 1950, pp. 8-9.

[14] Williams, M., and Cannon, G. E., "The Evaluation of Filtration Properties of Drilling Muds," *Oil Weekly*, p. 90, (2), 25 (1938).

[15] Byck, T. H., "The Effect of Formation Permeability on the Plastering Behavior of Mud Fluids," *Drilling and Production Practice*, p. 46, (1940).

[16] Private Communication from G. W. Breger, Dicalite Company, Walteria, California.

[17] Dickey, G. D., and Bryden, C. L., *Theory and Practice of Filtration*, Chap. 3, Reinhold Publishing Co., 1946.

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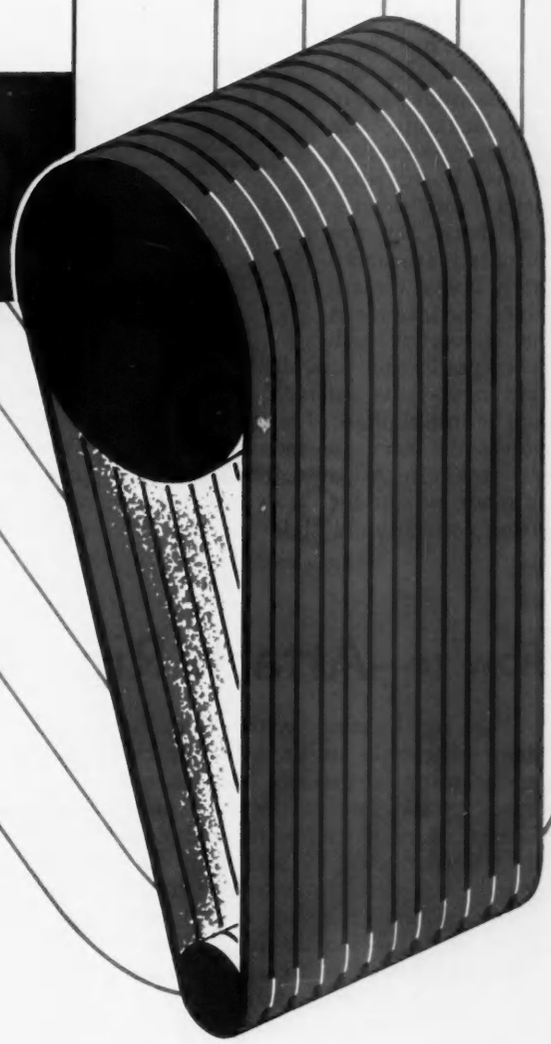

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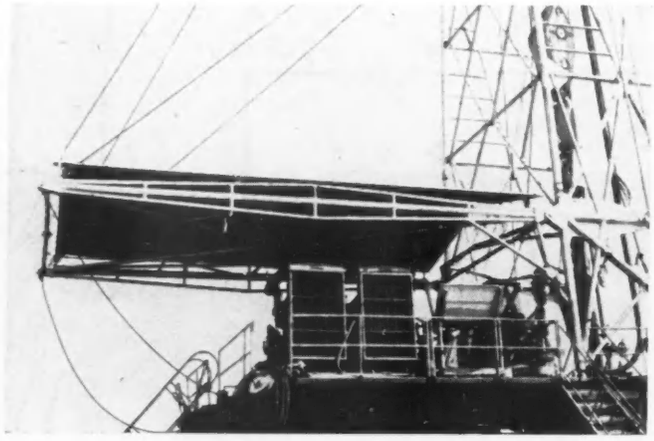
HOW TO—Convert Jackknife A-Frame Into a Shelter

The utility of the A-frame on a jackknife derrick can be increased by converting the unit into a shelter after the rig has been erected. Although an essential part of the jackknife, this A-frame serves a limited purpose after the derrick has been set up. Situated immediately above the engines, the frame can be converted with a tarpaulin to provide a desirable and inexpensive shelter.



The initial phase of construction involves the accurate measurement of the jackknife A-frame. Then a frame is made of one-inch galvanized pipe using conventional slide and key fittings. This practice is observed to allow the rapid dismantling of the shelter prior to lowering the mast. The center of the frame has two-foot pipe extensions on each end to provide sufficient pitch and proper drainage. Each extension is designed with a screw type adjusting member to relieve tension or to tighten the canvas shelter. The two extensions are connected with a long section of pipe over which the canvas is drawn and clamped. Brass eyelets are stationed at one-foot intervals completely around the canvas tarp. The canvas is then secured in position with rope lacing.

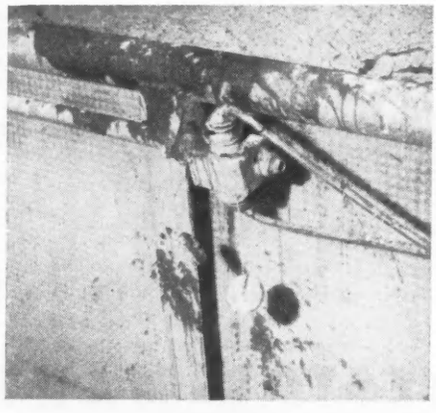
The shelter frame is fastened to the jackknife A-frame at six different points by means of metal bolt clamps. Extensive field service has proved that the anchoring of the shelter in six different places will provide the desired protection even in high winds.

In transport, the frame members of the shelter are tied to the side of the jackknife. Of course, the folded canvas tarp should be stored in an enclosed shelter to reduce the possibility of mildew or similar damage.

HOW TO—Attach Rig Lighting System to Mud Tank

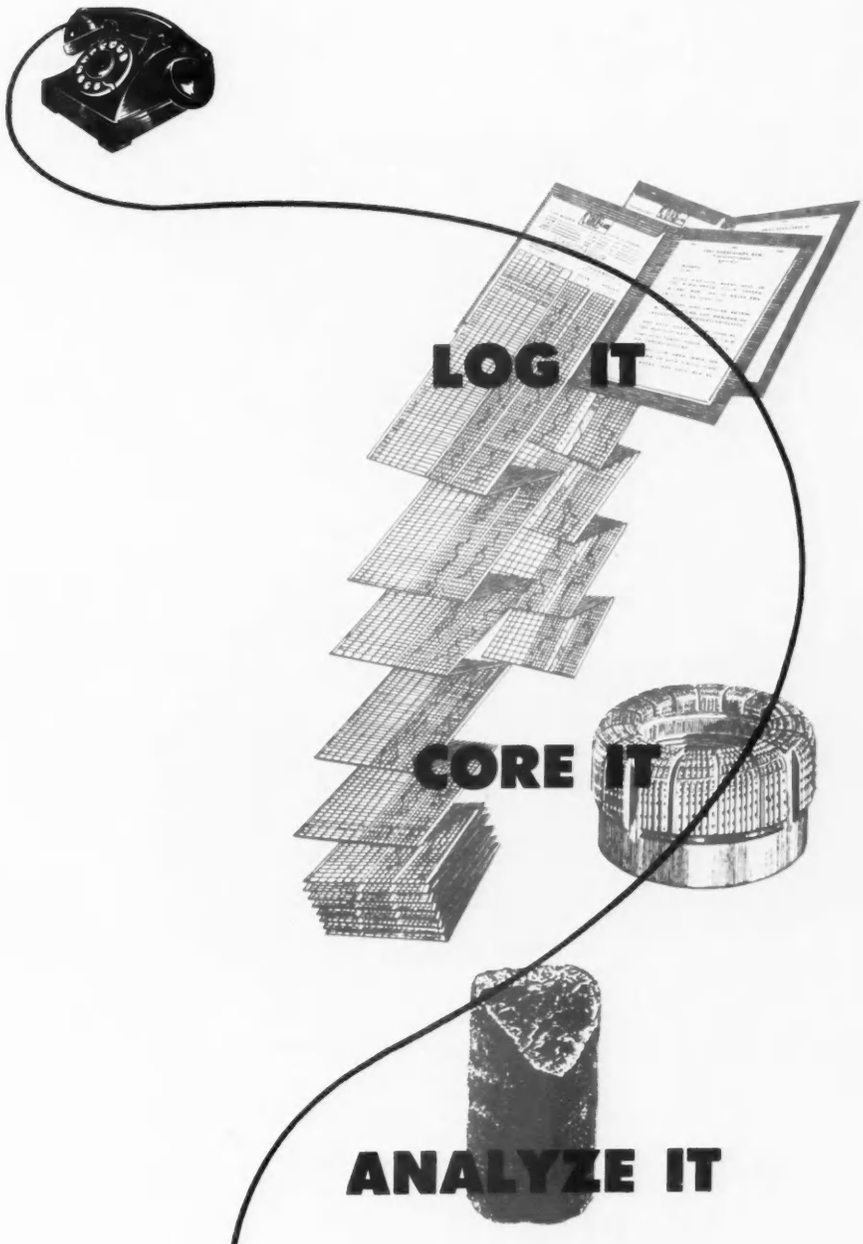
The rig lighting system can be more efficiently unitized by attaching waterproof conduit and journal boxes to the side of the mud tank. The standard three-fourths-inch conduit is connected by means of one-fourth-inch shoe-plates welded to the top reinforcing member of the mud tank. A three-fourths-inch hole is drilled in the plate to accommodate the electric conduit and, if desired, the conduit can be brazed in place permanently.

The conduit system is extended along one side of the mud tank with a journal box at each end to facilitate quick coupling of the system. Junction outlets are placed in the center of each length along side the tank to permit connecting floodlights at strategic points. Each outlet is supplied with cap-type screw covers to assure complete waterproofing when not in service.



The advantage offered by the installation is that it becomes unnecessary to rigup temporary light poles and string lines to provide the necessary lighting facilities on location. With the illustrated provision, one man can assemble the lighting system in minimum time.

Prior to a rig move, dismantling the system simply involves disconnecting the extension wires for storage in a tool house. The conduit system, being in a protected spot, need not be disconnected.



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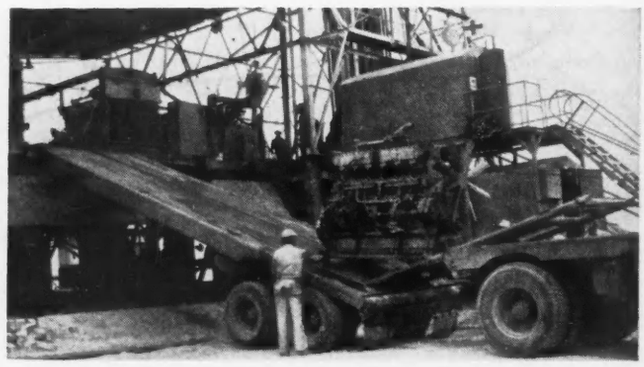
HOW TO—Improvise Transfer Ramp



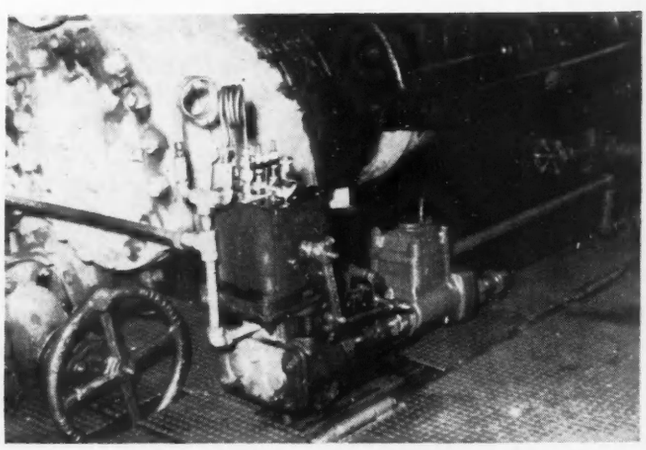
Rig motors, positioned on high substructures, can be changed rapidly by using an ordinary truck float as a ramp. The procedure involves spotting the float with the wheels away from the rig. Attached to the bolster end of the float is a winch line threaded through a snatch block anchored to a secure spot on the floor beams. By spooling-in the winch line, the end of the float will rise to the engine floor level. At this point, the end of the float is securely chained and boomed to the engine substructure.

In removing the engine from the substructure, the winch line from the truck backed against the float is attached to the radiator end of the engine, while a snub line extending from a second truck runs through another snatch block to connect to the back end of the engine. The lead truck then pulls the engine across the substructure floor and onto the ramp while the snub line from the second truck governs movement of the engine down the float. Wooden skid blocks are attached to the engine base to facilitate easier sliding and to eliminate the possibility of damage to the float bed. Once the engine reaches the end of the float bed, it is winched across a welded pipe frame and onto the truck bed.

The engine is securely boomed to the bed, the winch lines are unstrung and the two trucks exchange positions. The replacement engine is then transferred up the ramp to the substructure by means of the winch line from the truck.

The entire procedure can be completed in a short time under safe working conditions and the application of this idea will eliminate the necessity of constructing special ramps for engine transfer.

HOW TO—Lubricate Mud Pump Rods



A small, surplus steam pump can be used to lubricate the mud pump rods on either a steam or power rig. Steam is employed as the actuator on a steam rig whereas compressed air can be utilized on a power rig. Actual installation of the unit will require minimum expenditure in parts and manpower and the ultimate economic advantages of the unit will be readily observed.

The pump, which is usually a 2 x 4 x 2, is mounted on the mud pump skid. Lubrication of the illustrated pump is provided by a force feed unit. A lube storage reservoir is

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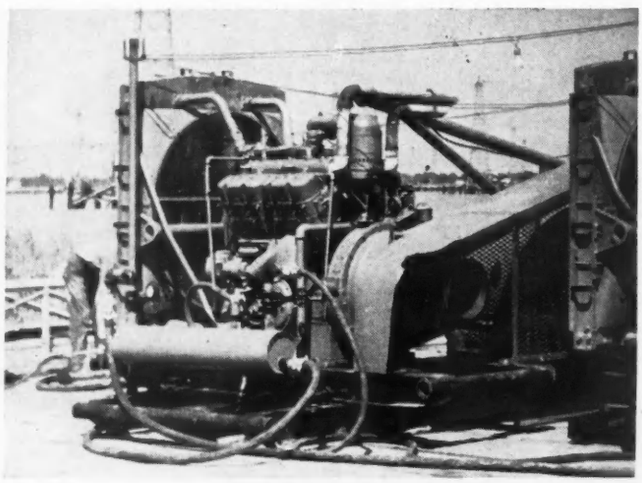
installed immediately below the pump bed and may be welded to the inside of the skid beams. Baffle plates are installed within the reservoir and oil is pumped from a connection near the top of the tank to eliminate the possibility of circulating residue mud or water. A small drain is installed in the scavenger chamber of the reservoir to provide an exit for water and mud.

Piping requirements of the system need not exceed a three-fourths-inch diameter. So long as that size pipe is employed, an adequate flow of lubricant over the pump rods will be assured.

The iron piping system is permanently installed along the skid unit. Oil is circulated from one mud pump to another by means of rubber hose equipped with quick coupling unions. The process of tearing down the lubricating system simply involves disconnecting the rubber hose sections and tying them to the mud pump skids.

Field experimental work has revealed that ordinary lube oil, water emulsions or soap solutions of ordinary laundry additives, will insure proper lubrication and the extended service life of the mud pump rods. The latter mixture seems to offer the advantage of increased economy since the solution may be blended at a nominal cost and may be discarded, with little monetary loss, in the event the solution becomes contaminated.

HOW TO—Install Dual Service Tank



A dual service fuel volume tank can result in increased equipment portability and lower initial rig-up expense. One operator has installed a fuel volume tank on one engine to service the two engines connected to mud pumps. Constructed of 13⅜-inch casing with welded cap ends and fuel outlets, this non-baffled tank provides a sufficiently large volume of gas to eliminate surge operation of the engines.

The tank is attached to the engine skid by means of four two-inch pipe legs which slide into sleeve type adapters welded to the top face of the base skid. This means of installation permits removal of the unit from the skid in case additional work space is needed around the engine. A two-inch collar is welded in one end of the drum to permit entrance of the gas into the system. Fuel is fed to the engines through two two-inch outlets welded in the top portion of the tank. Each outlet is equipped with a gate valve so the tank can be blocked from the system in the event repairs are necessary. A short two-inch nipple, a two-inch ell, a two-inch to one-inch swage and a hose coupling are installed immediately above the gate valve on the fuel outlet line. The ell connections are provided to prevent kinking of the rubber fuel supply line to the engines.

High pressure rubber hose supplies fuel gas to the volume tank and from this vessel to the engines. Quick coupling hose unions expedite the process of rigging up and tearing down the equipment. The feed line to the volume tank is two-inch hose whereas the supply lines to the engines are one-inch.

Construction expense of this dual volume tank is noticably lower than the expenditure involved in building individual tanks for each engine. Another advantage in this design is that the work space around only one engine is limited while the other engine, which does not have a volume chamber, is free of obstructing accessories.

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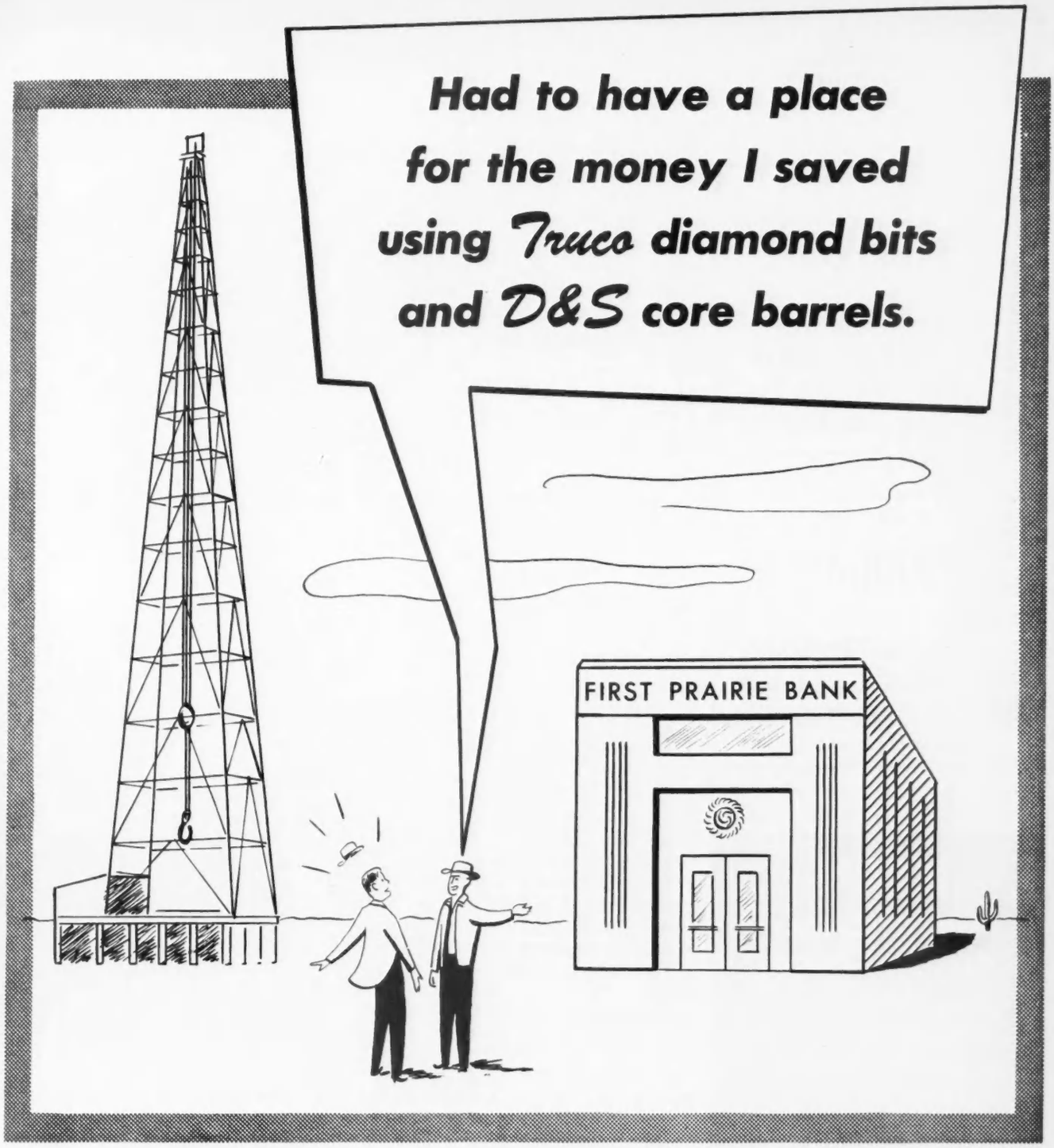

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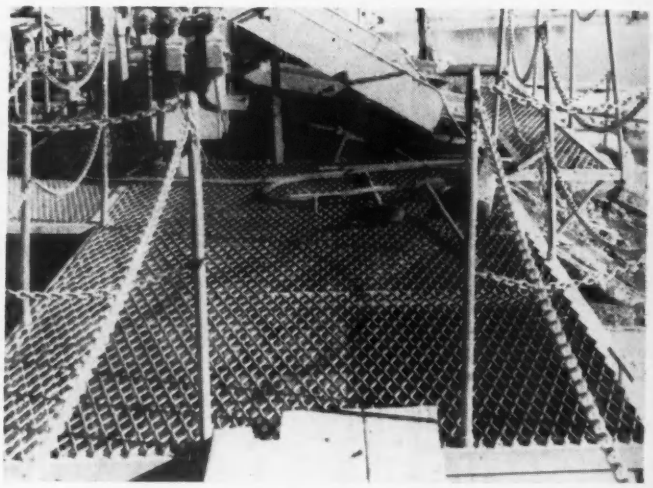
HOW TO—Build Walk Over Tanks



Installation of an expanded metal walkway on the mud tanks will eliminate the necessity of building special walks alongside the tanks. Most mud tanks are flanged around the top edge to insure adequate reinforcement and, if this structural feature is present, the installation of the walkway is a very simple matter.

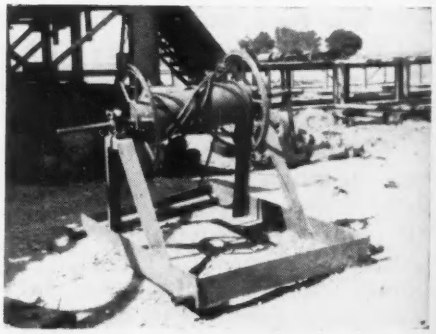
If the top of the flange is slightly countersunk below the edge of the tank, the expanded metal can be cut to rest atop the flange. The side of the tank will serve as a retainer and will not permit the walkway to move from the proper position. If the reinforcing flange is flush with the top edge of the tank, the expanded metal walkway can be bolted into position. The large section of expanded metal is supported by cross braces which are normally a part of the mud tank.

Hinged extension walkways are installed around the shale shaker unit to provide access to the unit for maintenance and sample collections. These walkways are constructed of 1½-inch angle iron frames covered with expanded metal. Pin hinged to the side of the mud tank, the extension walkways are supported by one-inch pipe legs which hinge to the frame and fit in slide adapters welded to the base of the mud tank.

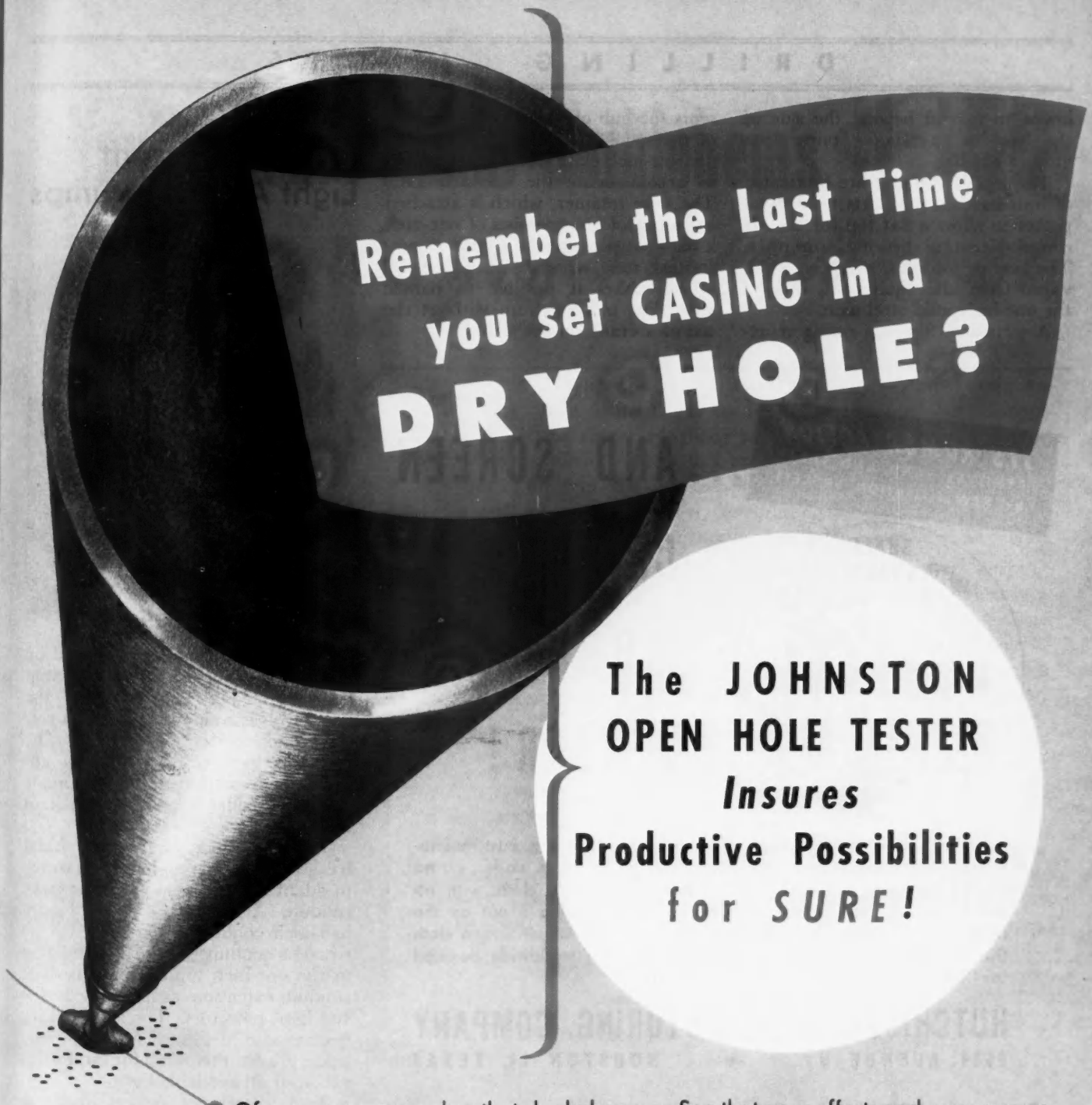
The guard rail system, which surrounds the mud tank and extension walkways, is fabricated with one-inch collars welded to the mud tank flange. The threads within the collars have been reamed to provide a smooth, sleeve type fitting. The guard rail extension posts consist of 1-inch x 4-foot nipples with the top end orangepeeled and seal-welded. The lower end of the post has been buffed to permit proper fitting in the reamed, one-inch collar adapter. The posts are tapped in two different places to accommodate quarter-inch carriage bolts which are bent to support the chain guard.

For rig transport, the expanded metal walkway is removed to permit cleaning the mud tanks. Then the walkway is replaced, the extension walkways folded against the side of the tank and the guard rail posts removed from the adapter sockets. Removal of the light guard chain is unnecessary since the chain and the support posts may be rolled together.

HOW TO—Make Rigup Line Spool



The problem of handling and protecting rig-up lines can be solved through the construction of a simple, inexpensive spooling device. The base of the illustrated unit is built of welded sections of five-inch derrick legs. Segments of two-inch pipe have been extended through doors cut in the side of the base and are securely welded to provide necessary pick-up bars. It may be noted that each end of the two pick-up bars has been al-



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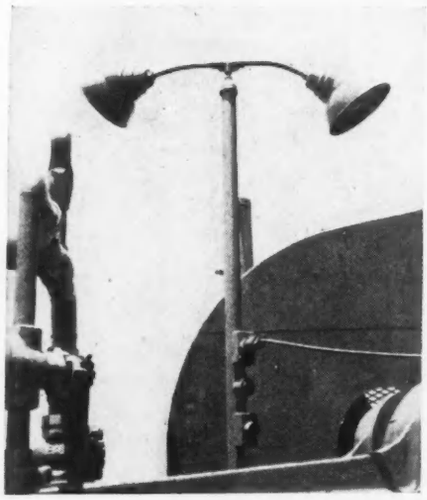
lowed to extend beyond the side of the base to facilitate tying lines around the bar.

The legs of the unit are fabricated of four-inch derrick girts welded together to allow a flat top for the accommodation of bearing journals. The bearing journals, which were salvaged from idle equipment, support the one-inch solid steel axle.

A section of 9⅝-inch casing represents the hub of the spool. Each end of the spool is sealed with section of quarter-inch plate steel, center-drilled to accommodate the one-inch axle. The rope retainer, which is attached to the spool hub, consists of one-inch x one-foot pipe spokes welded to preformed steel wheels. The flanged wheel makes it possible to handle spool line on the drum without the aid of a crank on the shaft.

HOW TO—
Insure Sufficient Light At Mud Pumps



Mud pumps can be well lighted by a portable, compact light stand atop the pump case. Fabrication of the unit involves welding a two-inch collar on top of the pump case. The two-inch light stand, which is approximately four feet high, is made up in the collar when the unit is in use.

The top section of the light stand has a two-inch to one-half-inch swage to adapt conventional electric wiring conduit. A one-inch section of one-half-inch conduit is made up in the swage, a conduit type "T" is attached to the one-inch nipple, and one-foot conduit extension arms connect the two light reflectors. The attached reflectors are designed to direct the beam toward the pump for total utilization of all available light.

Two waterproof outlets and one waterproof switch, connected in series, are bolted to the side of the light post. By attaching a quick coupling hot wire extension to one of the electrical receptacles, the one light will operate. The other socket is provided to accommodate extension service wiring leading to other electrical apparatus. All wiring for the unit is enclosed by either the two-inch lamp post or the ½-inch electrical conduit. Thus, the entire system is completely waterproof.

The arrangement of this lighting system is of special advantage when a pump or belt drive requires repairs after dark. Although more expensive than the usual makeshift lighting system, the advantages offered by this efficient unit are tangible.

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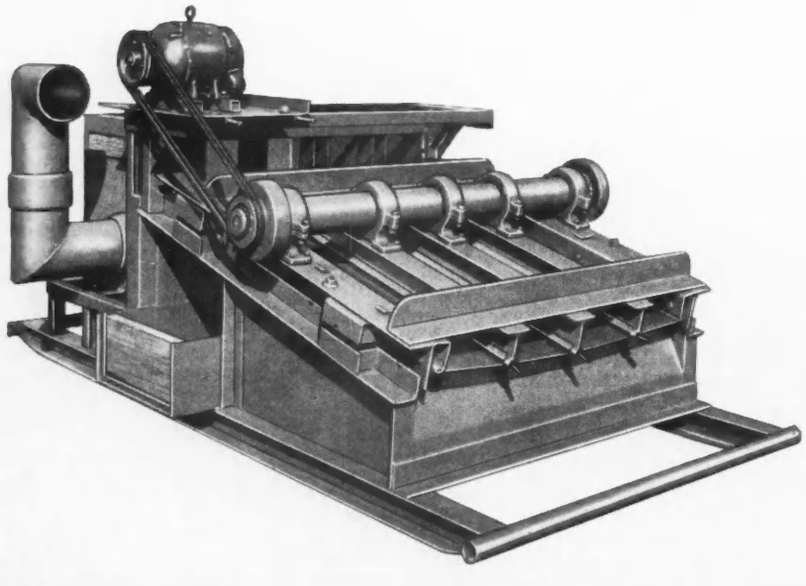

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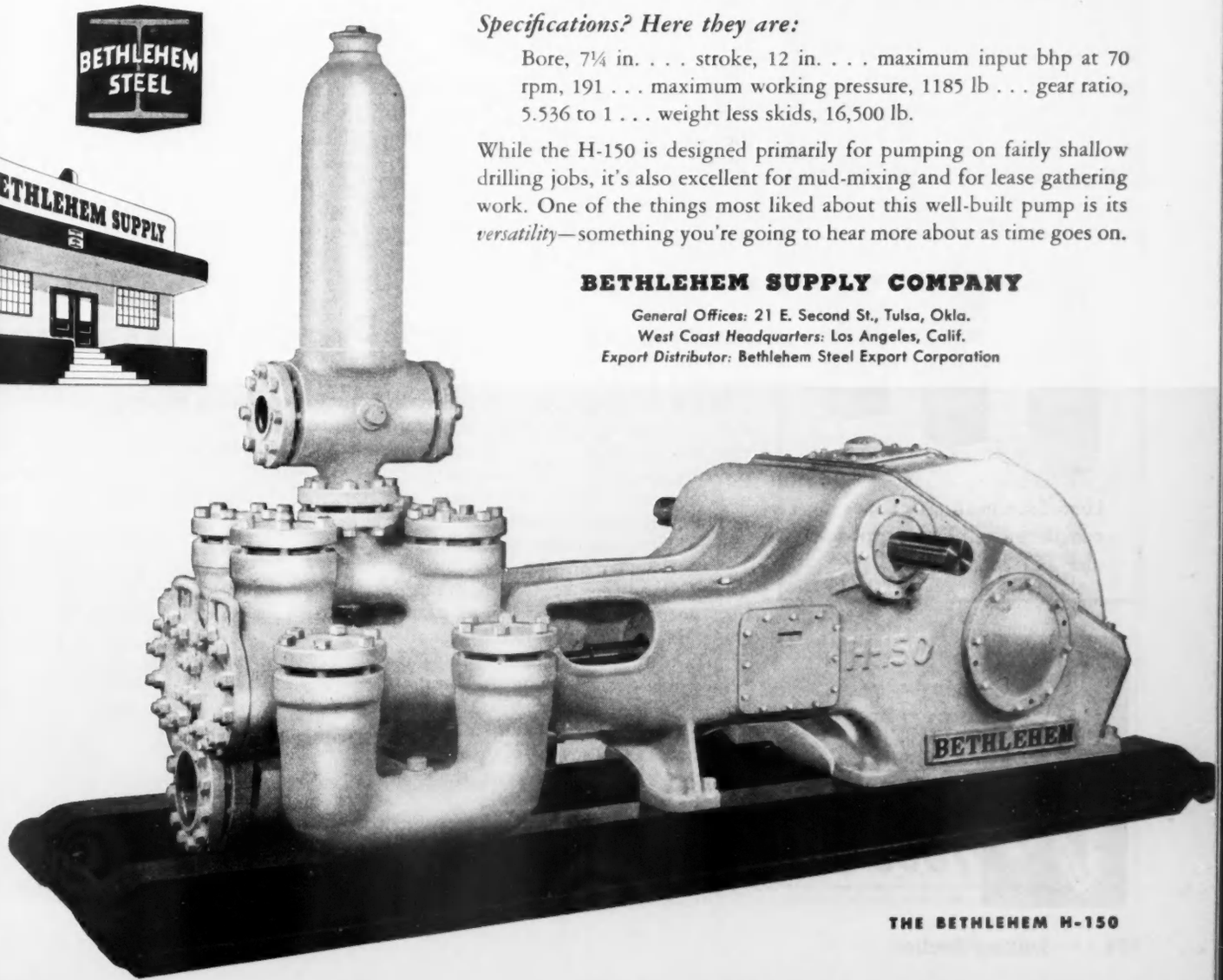

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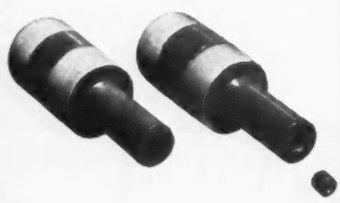

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HOW TO—Build Permanent Mud Jet

Permanent jets installed in tanks will expedite the process of moving and rigging-up the mud system. Construction of the illustrated unit consists of welding a three-inch pipe reinforcing member across the tank. For maximum efficiency, the reinforcing bars should be stationed toward each end of the tank to accommodate two jets.

The jet standpipe is made of 5½-inch pipe fabricated with a welded, double-feed tee at the base. The two-inch jet line enters through a door in the side of the tee. The jet line extends to a point within the tee where it is possible to center position a two-inch ell. A two-inch to ½-inch swage is made up in the ell to create the jetting action within the standpipe. The jet line is anchored to the side of the standpipe by means of a welded, quarter-inch steel plate bracket. Additional plate brackets are welded to the standpipe to allow bolting the unit to the three-inch reinforcing cross-member.

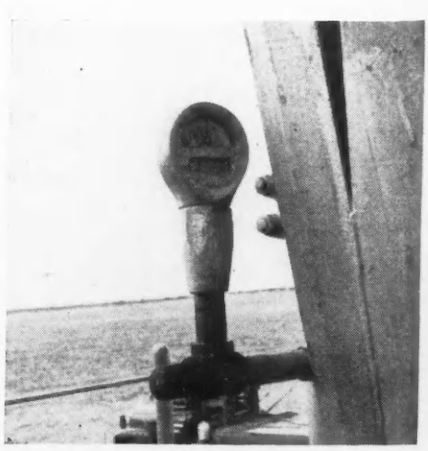
The height of the standpipe is governed by the vertical dimension of the side of the tank. It is desirable to extend the top of the standpipe to the level of the tank sides. Hammer type unions connect the standpipe and the line which discharges mud into the reserve pits. The flexible feature of the system is attributed to the hammer union which, when partially disengaged, permits swinging the extension discharge line over the tank.

The system will offer greater utility if the two-inch mud jet lines are permanently welded to the side of the tank. Between tank junction of the jet feed system can be provided by high pressure hose segments or pipe nipples.

HOW TO—Rig Mud Pressure Gauge

When the standpipe is installed on the drawworks side of a jack-knife rig, it is possible to connect the mud pressure gauge to the standpipe with a minimum number of fittings and provide an unobstructed view of the gauge. One operator has welded a two-inch collar in the standpipe to adapt a one-foot × two-inch nipple and accessories necessary to attach the mud gauge. The two-inch collar is placed approximately four feet above the derrick floor to eliminate the possibility of damage to the gauge while equipment is being moved on the rig. At this level, it is convenient for the driller to observe the mud pressure at all times.

Prior to rig transport, the gauge is removed, with the two-inch fittings remaining on the standpipe. In the event there is danger of damaging these companion fittings, a union can be attached close to the two-inch collar so that the entire assembly can be removed when the rig is torn down.



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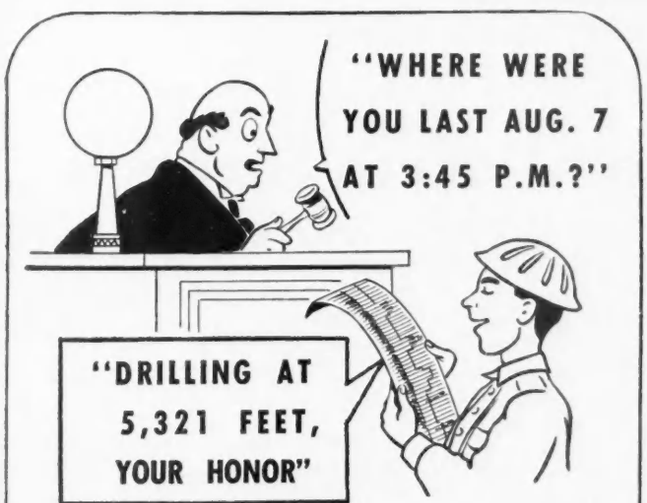

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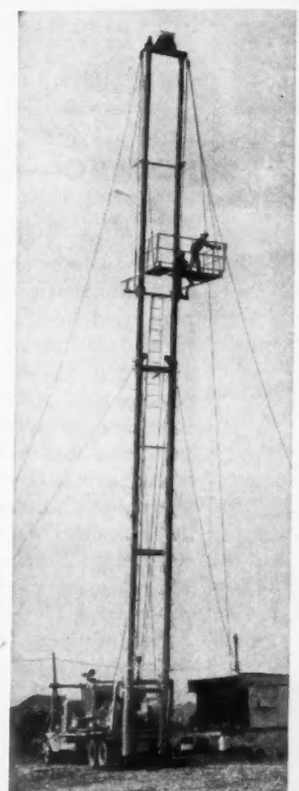

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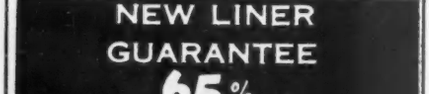

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A mercury switch, attached to the rocker arm of a boiler feed pump, serves as the pilot unit for a unique warning device. Acting as a circuit breaker, the switch will cause a signal light to operate as the pump strokes and the fireman can observe the performance of the boiler feed unit from a distance.

The mercury switch is housed in a tin jacket and bolted or strapped to the pump rocker arm. A heavily insulated double wire is attached to the terminals on either end of the switch element. The drop cord must be free to swing with each movement of the rocker arm.

The extension to the mercury switch is spliced into the rig direct current system and connected to a light located in an unobstructed spot on the boiler feed unit.

Most boiler feed units are equipped with at least two or three boiler feed pumps. In such cases, the same installation may be made and the signal lights painted different colors to identify each pump.

The installation of this inexpensive signal device will permit the boiler fireman to assist in work around a rig, particularly during a trip, and yet he will know the operating characteristics of each feed pump.

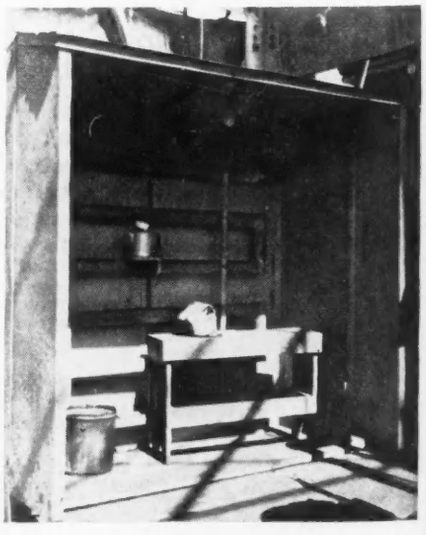
HOW TO—Erect Driller's Shelter

A simple shelter can be fabricated of lightweight sheet metal to provide protection for the driller and rig personnel working on the floor. Structural features of the shelter include a welded 1½-inch angle iron frame plus hinged roof and side extensions intended to reduce the over-all dimensions for transport. The angle iron frame is covered with light gauge sheet metal anchored by spot welding.

The sheet metal floor is covered with 2 x 12-inch lumber which may be replaced as wear becomes more progressive.

Steam coils, constructed of three-inch pipe, are bracketed against the back wall of the shelter. The lead line on the steam coil is equipped with a one-inch control valve for complete governing of the heat. In this manner, it is possible for the shelter to function as a radiant heater, reflecting heat toward the drill position, when the rig is being tripped.

Constructed of metal remnants, the shelter does not represent a heavy investment. Amortization may not be accounted for in direct monetary consideration; however, one may foresee increased morale among crew members through the installation of this unit.



Additional Oil Production Through Flooding with Carbonated Water

By JAMES W. MARTIN

Consulting Engineer, Oil Recovery Corporation, New York City

THE USE OF carbonated water in flooding programs has considerably increased oil recoveries as indicated by laboratory and field tests. The author describes the results of laboratory tests and discusses two field tests under way. An achievement of this water-flooding process is that as much as 75 percent of the recoverable oil may be obtained with water containing a 25 percent solution of carbon dioxide. This paper was presented at the 28th annual meeting of the Pennsylvania Grade Crude Oil Association, Pittsburgh, June 14, 1951.

AN EVER-INCREASING amount of development work is being applied to the improvement of the secondary recovery of oil. Until recently, however, most of this development has been in the application of mechanical and physical means of removing the oil.

Several years ago, in the search for broader markets for carbon dioxide, certain reactions between carbon dioxide and petroleum were found to have commercial possibilities. Work on treating oil sands with carbon dioxide was initiated and this new development in secondary recovery resulted. This development, to a large extent, is the application of chemical means of removing the oil.

For several years research work has been under way in our laboratories toward the improvement in the recovery of oil through the use of carbon dioxide as a component of both gas drives and water floods. This paper deals particularly with that section of work covering the results of the use of carbonated water or brine on oil sands.

Results of this work have been most encouraging. When applied under controlled conditions, a relatively dilute solution of carbon dioxide in water or brine seems to condition the sand and its oil content so that a substantial increase in oil recovery results.

The process described herein adds little energy to the reservoir. It is more a chemical treatment of the sand than it is a source of energy.

Under certain conditions a 25 percent solution of carbon dioxide in water is capable of removing better than 75 percent of the recoverable oil. Figure 1 shows the effect of carbon dioxide concentration on oil recovered. This curve is drawn with the percentage of total oil recovered at pressures of 800 pounds per square inch and temperatures of 75° F. The first 25 percent carbonation of the water conditions the sand so that approximately 75 percent of the oil can be recovered. Recovery of 100 percent is taken as the total oil that can be removed from the sand by carbonated water.

As an example of its application to actual cores, one set of tests run on some 35 Mid-Continent cores gave the following average results. This is shown in Figure 2.

Estimated Initial Residual Oil, 30 percent of pore space

Estimated Residual Oil Economically Recoverable by any Present Methods, 23 percent

Actual Residual Oil after Treating Cores with Carbonated Water, 8 percent.

Factors Influencing Oil Recovery

Laboratory work has shown that several factors affect the recovery of oil by this new process.

1. The degree of carbonation of the water. As shown in Figure 1, the oil recovery increases with the degree of carbonation of a water, but past a certain degree of carbonation (in the neighborhood of 20 to 30 percent of full carbonation), the amount of oil recovered increases more slowly with increased carbonation.

It does not require high concentrations of carbon dioxide to cause reactions bringing about the release of the major amount of oil from the sand. These reactions are accomplished by this relatively dilute solution of carbon dioxide in the oil and water. Because of the relatively small proportions of carbon dioxide that are required this phenomena makes the commercial utilization of this process possible.

Additional increase in oil recovery above that was brought about by this limited concentration of carbon dioxide is in the nature of a straight line function and is probably largely dependent on the increase in formation volume that is brought about by the solution of carbon dioxide in the oil. In many sands one may not be warranted in attempting to obtain this last incremental increase in oil recovery through the use of more concentrated carbon dioxide.

2. Temperature of the oil sand. It has been found that increased temperature promotes the recovery of oil when carbonated water is employed. This is a general statement. It is hoped that curves showing the effect of temperature on both low-temperature oil sands and on the high-temperature sands of the South and West will be published soon.

3. Pressure of the oil sand. Oil recovery increases with increased pressure starting at a minimum of approximately 500 pounds per square inch at normal temperatures and for most crudes. Below this critical pressure the effect of pressure increase on oil recovery is small. Above this critical point the effect of pressure is increasingly greater.

4. Nature of the crude. Generally speaking, it can be said that oil recovery using this process increases with the API gravity. The lighter oils are best. It appears to be better with certain paraffinic base oils than with naphthenic but is better with naphthenic than with asphaltic and would be even better with aromatic type of

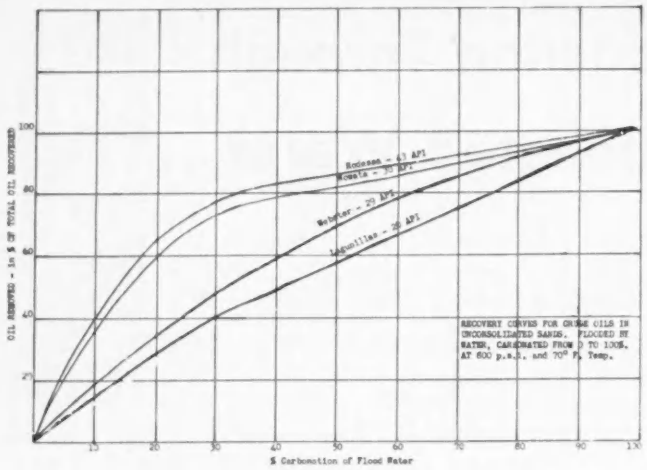

OIL RECOVERED - in % OF TOTAL OIL RECOVERED
% Carbonation of Flood Water
RECOVERY CURVES FOR CRUDE OILS IN UNCONSOLIDATED SANDS, FLOODED BY WATER, CARBONATED FROM 0 TO 100%, AT 600 p.s.i. and 70° F. Temp.

FIGURE 1

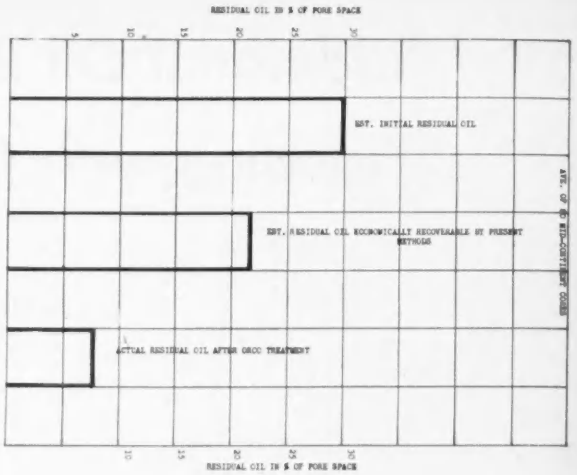

RESIDUAL OIL IN % OF PORE SPACE
EST. INITIAL RESIDUAL OIL
EST. RESIDUAL OIL ECONOMICALLY RECOVERABLE BY PRESENT METHODS
ACTUAL RESIDUAL OIL AFTER CO2 TREATMENT
RESIDUAL OIL IN % OF PORE SPACE

FIGURE 2

crude than with paraffinic (Figure 2). The above statements are only indicative as there are variations within these general rules.

It is noteworthy that on a curve similar to that given in Figure 1, if an asphaltic type crude is used, the curve becomes almost a straight line. In the paraffinic, naphthenic, and aromatic, a sudden and unexpected curve is obtained in the lower concentrations of carbon dioxide.

5. Natural gas content. The oil recovery increases with the natural gas content of the crude oil. In case the crude is "dead," it will probably pay to pre-inject some natural gas.

Results of Field Tests

The above information is based largely on laboratory work done on unconsolidated sand and work done in a commercial core laboratory on a wide variety of actual cores.

At present there are two field tests under way. Both are on depleted sands, i.e., on sands that have been water-flooded to their commercial limit and the carbon dioxide treatment, as applied to them, could be called a tertiary recovery rather than a secondary recovery.

There are good reasons to believe that this process can best be applied as a component of an initial water flood where water-oil ratios are still low rather than as a tertiary recovery after normal water flood is completed. Such tests as these on watered out areas, however, have the virtue of giving assurance that whatever oil is recovered is due solely to the introduction of carbon dioxide.

The first test in Allegany County, New York, was a test flood on a half acre five-spot, and while incomplete, it shows the results of 17 months' operation which include the peak of oil production.

The second test, started 15 months after the first test, is in northern Oklahoma and consists of four 5-spots covering a total of ten acres. Carbon dioxide is now being injected prior to beginning a followup water flood. Results of the treatment will not be evident in this latter test area for several months.

In the first, and as yet incompleted test, the following phenomena have been observed: 1. Increased injectivity. The use of carbonated water increases the water injectivity of the oil sands. The injectivity of some injection wells were increased approximately 50 percent, and in other wells in fairly tight sands, relatively small amounts of carbonated water doubled the injectivity.

The field work done so far could well indicate that this factor may assist in developing certain tight sands.

Work on cores from carbonate reservoirs indicates that injectivity is substantially increased although actual porosity increases to only a limited extent.

2. Production of natural gas. Use of carbonated water promotes the production of natural gas from a water flooded oil sand. In some oil sands that had been water flooded over a period of years, and in which the gas content of the oil was less than 25 cubic feet of natural gas per barrel, the amount of natural gas produced during the carbon dioxide flood increased to approximately 300 cubic feet per barrel of oil. The gas so produced was a remarkably rich gas.

Whether these lighter hydrocarbons were originally in solution in the water of the oil sand or came from the oil is still an open question.

3. Production of unsaturated hydrocarbons. The use of carbonated water brings about an abnormally high percentage of unsaturated hydrocarbons (ethylene, propylene, etc.) in the produced gas. In an actual field test the produced natural gas which, prior to the advent of the carbonated water in the sand contained less than 1 percent unsaturated hydrocarbons, increased in unsaturated hydrocarbons to around 20 percent.

4. Production of organic acids. The use of carbonated water promotes the production of organic acids or their salts in the oil sand. Not only were the organic acids found to be present in produced water, but evidences of their solvent action on the minerals in the sand were also found. The sand appeared to have been treated with organic acids because of the nature of the salts washed out of the sand. Among the salts that came out was a heavy production of barium sulfate and carbonate and it was difficult to explain otherwise inasmuch as water had been passing through this sand over many years prior to this time. During the test flood large quantities were produced (more than a ton of barium sulfate and carbonate). Calculating it back, it is hard to believe that much barium sulfate and carbonate could be produced and put into solution, even though it had been transformed into barium bicarbonate. On the other hand it happens that barium formate, barium propionate, and some of the other organic salts, are extremely soluble—as soluble as calcium chloride. This seemed as evidence that organic acids had been formed, but in addition actual analysis was made of the organic acids in the produced water and they were proved to be present.

5. Corrosion. When carbon dioxide or carbonated water is used in the controlled concentration mentioned above, no evidences of corrosion were noted in the production wells or in any of the equipment used in handling the produced fluids. There is reason to believe that the carbon dioxide forms sufficient amounts of alkali and alkali earth carbonates and

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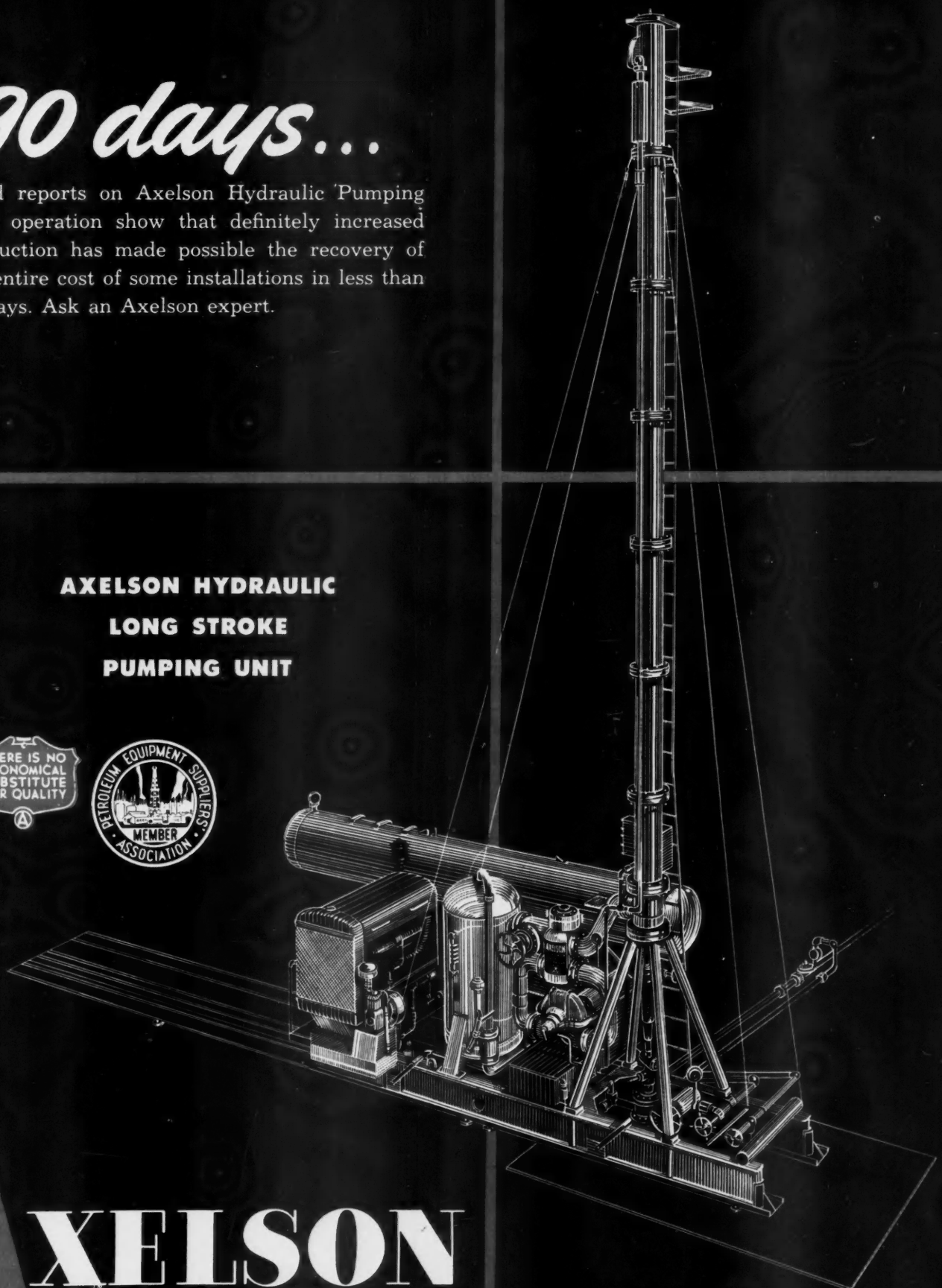

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bicarbonates so that these salts become buffers which prevent the corrosion of the steel.

Examination of coupons and analysis of the produced water for iron indicated that virtually no corrosion was caused by the use of carbonated water.

6. Production Well Plugging. The use of carbonated water does not present any difficult problems due to deposition of solids at the production wells and separators. Various alkali earth carbonates are formed and largely stay in solution, but if they precipitate, like this barium sulfate and barium carbonate mixture, they tend to flow out with the produced water and were caught in the separator where they settle out. They do not plug the wells and their removal as a suspension in the produced water is not difficult.

7. Recovery of carbon dioxide. A large proportion of the carbon dioxide used in this treatment is recoverable and is suitable for reuse. It is believed that as much as 75 to 85 percent of the carbon dioxide originally injected may be separated and reused thereby limiting the cost of the treatment.

8. No change in the nature of the oil by this treatment could be noted.

Why Carbon Dioxide Promotes Oil Recovery

1. Carbon dioxide reacts on some of the components of crude to form polar compounds. As one example, there are formed fatty acids and their salts. It is known that these compounds bring about a marked lowering of surface tension and also have effects on surface action in the sands.

2. Carbon dioxide is soluble both in oil and in water and thus penetrates to the surface of the sand grains whether the sand grain is water-wet or oil-wet.

3. Carbon dioxide has a property of materially limiting the adsorption on the sand of certain surface active agents, thus enhancing the usefulness of such adjuvants.

4. Carbon dioxide under high pressure has the property of forming loose compounds (or complexes) with some of the components of crude. These newly formed compounds are much lower in viscosity than the original crude. It can be said that they act as solvents for the crude.

5. Carbon dioxide promotes the solubility of natural gas in crude. It appears that natural gas is more readily soluble in the hydrocarbon-carbon dioxide compounds than in the crude. The two gases thus complement each other in their effect on the removal of the oil from the sand.

6. Increased injectivity is possibly brought about by several reactions:

(a) Carbon dioxide decreases the pH of the oil sand adjacent to the injection well. This would limit bacterial growths that now tend to plug the injection area.

(b) It also acts as a solvent for certain salts such as calcium carbonate whose crystals clog the passages between the sand grains.

(c) It is thought possible that the presence of carbon dioxide tends to shrink some of the clay found in an oil sand and thus render a dirty sand more permeable.

The treatment of an oil sand with a relatively dilute solution of carbon dioxide in water or brine so conditions the sand that more oil may be recovered than is possible with ordinary water flood or gas drive.

● It now appears that we can expect to get the residual oil down in the neighborhood of 10 percent, even though the residual oil left after water flooding is in the neighborhood of 25 percent.

● It is thought that the action of the carbonated water is chiefly chemical and is influenced by temperature, pressure, and nature of the oil.

● The injectivity of water into the oil sand is improved by means of carbonated water.

● This treatment promotes production of certain valuable petroleum gases.

● Neither corrosion nor deposition of solids have offered serious handicaps to the field application of the process.

Carbon dioxide can be produced in the oil fields on a commercial scale for about $15 per ton of carbon dioxide. This cost contemplates production of carbon dioxide from fuel oil and includes delivery of the gas at pressures above 800 psi and also includes amortization of the plant in ten years. Carbon dioxide plants designed for this service may be readily dismantled and removed by truck to new locations.

The cost of the incremental oil produced by this method may be in the range of 35 to 90 cents per barrel, depending on field conditions. These figures contemplate that recovered carbon dioxide is reused.

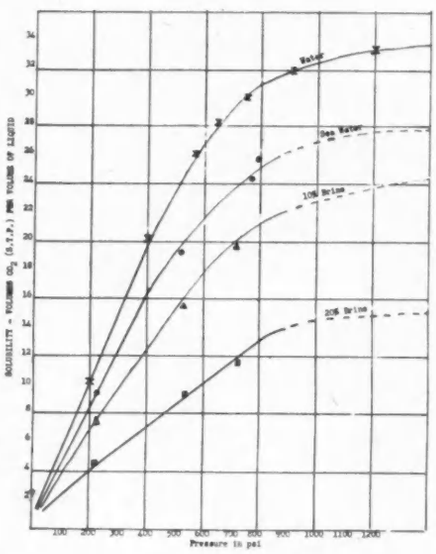

FIGURE 4. Solubility of CO_2 in brine at 70° F.

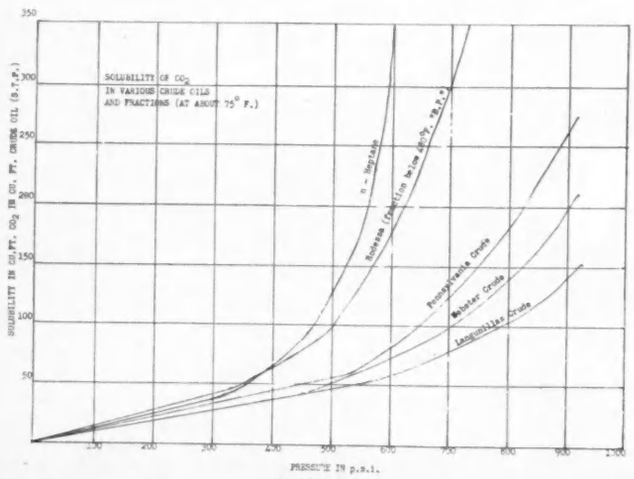
SOLUBILITY OF CO2 IN VARIOUS CRUDE OILS AND FRACTIONS (AT ABOUT 75° F.)
n - Heptane
Pennsylvania Crude
Webster Crude
Longnecker Crude
PRESSURE IN p.s.i.

FIGURE 3

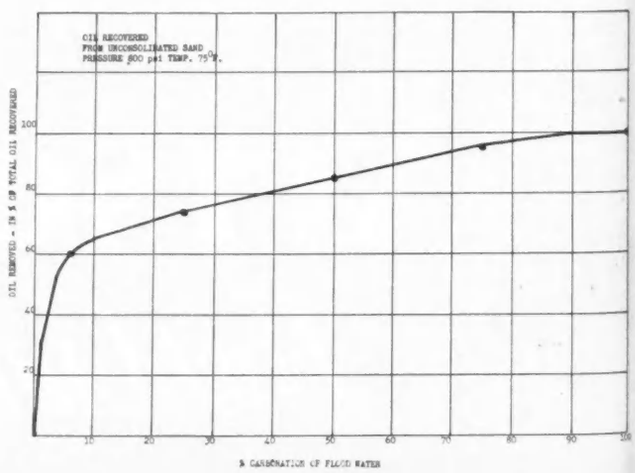

FIGURE 5

THE FULL-HOLE GRAVEL PACK . . . A NEW COMPLETION TECHNIQUE

By R. L O'SHIELDS and M. F. HAWKINS

Louisiana State University, Baton Rouge

A NEW COMPLETION practice in fields having sanding problems is discussed. While full-hole gravel packing of wells in this category has been attempted in the past without much success, the author describes the factors which effect such completions. This new method is designed to eliminate use of liners. Laboratory tests and theoretical analysis show that this method is practical, and it has been tried with some success in the Leeville field of Louisiana by the Latex Gulf Oil Company.

A NEW method of full-hole gravel packing wells eliminates the need for a liner, and has met with success in the Leeville field, Louisiana, where this technique has been tried by Latex Gulf Oil Company. While open-hole gravel packing has been attempted in the past to overcome the major problems of pulling a liner to work over gravel-packed wells, it did not meet with satisfactory results. Recently, several operators in fields where troublesome sanding conditions are present have developed gravel pack settings with emphasis on reducing the initial cost of the completion and on minimizing the difficulties of workover procedures.

The new technique involves dropping pea-size gravel (0.187-0.250 inch) into the casing and completing with a hookwall packer, with a perforated nipple about ten feet above the top of the gravel. The usual sequence of events is that the well flows for a period of time, is gas lifted for another period, and eventually has to be reworked. This, however, is a relatively simple matter, for it only requires pulling the packer, washing out the sanded gravel, repacking with clean gravel, and putting the well back on production. The fact that temporarily good results are obtained with this method suggested the possibility of developing a pack along similar lines which would exclude the sand and be more permanent in nature.

Experimental Work

The experimental apparatus consisted of a radial flow, sand reservoir tank, 32 inches in diameter, 24 inches thick, and concentrically fitted with 5-inch casing, containing 8 half-inch perforations in the bottom 12 inches. The casing used above the tank was an 8-foot section of 5-inch lucite pipe. The periphery of the tank was made of two shells; the inner shell was drilled with 100 holes into which slotted screen buttons were inserted. The outer shell contained two fluid inlet connections. This design assured a uniform pressure at the outer edge of the sand during radial flow tests.

TABLE 1
Gravel Permeabilities

Gravel Size (Inches)	Permeability (Darcys)	Pressure Drop Per Foot of Gravel (psi.)
.030—.045	1100	0.595
.040—.060	1500	0.437
.060—.090	2100	0.312
.090—.125	2700	0.242
.125—.187	4000	0.164
187—.250	5500	0.119

Figure 1 is a photograph with tests in progress.

A bypass connection was made to the bottom of the casing so that either linear flow through the casing or radial flow through the sand reservoir could be obtained. The remaining equipment consisted of two rotary gear pumps, a flowrator, a discharge drum and the necessary piping connections.

Effects of linear flow through gravel columns was investigated by flowing water through gravel that was placed in the five-inch lucite pipe. The coupling from the lucite to the casing of the sand tank was fitted with a screen. This confined the gravel to the lucite tube where its movement under various flow conditions was readily observed.

The behavior of gravel during the linear flow tests proved of interest. At low flow rates there was no movement of the gravel column at all. With slightly higher rates the column began to grow with only a general loosening of the pack and no movement of individual grains. At first, particle movement was confined to local spots in the column; on increasing the flow again these local spots became larger and joined with others, resulting in a gentle refluxing of the gravel throughout the pack. As flow became greater the reflux rate became faster and soon was turbulent in nature. At the highest flow rates prior to washing gravel out of the system, rapid swirling of the gravel occurred during its reflex cycle.

All of the gravels tested followed this same sequence of movement. The flow rate at which movement com-

menced was greater for the larger sizes than for the smaller ones. Figure 2 shows the effect of linear flow on the height of an unsupported gravel column. Three heights of gravel were tested with each size gravel. The ratio of the column height at a particular flow rate to the initial height was the same for all three heights used; therefore, this parameter was used for the ordinate of the curves in Figure 2. The dashed lines encompass areas in which the same type of gravel movement was noted.

These flow tests clearly point out why the full-hole gravel pack has not been very successful. At low flow rates a pack containing fine gravel, which is capable of screening the sand, becomes very loose, presenting a virtually wide open avenue for the entry of sand. On the other hand, the larger gravels which do not become loosened at medium rates are not capable of screening the sand.

The permeability of each gravel size was determined from flow data taken before any gravel movement occurred. The effective permeabilities to water inside five-inch pipe are given in Table 1 along with measured pressure drops per lineal foot of gravel packed pipe for a flow of 100 barrels per day of a one-centipoise fluid. The significance of these values is that the smallest gravels used in sand exclusion possess a flow capacity many times that of a formation sand.

The full-hole pack is one form of a sanded liner; i.e., the bore hole is completely filled with a porous medium, which Muskat[1] has shown reduces well capacity. Because of the tremendous permeabilities of gravels, this effect is not so serious when clean gravel fills the hole. The small gravels recommended for Gulf Coast sands may, in many cases, possess 1000 or more times the permeability of the sand. Muskat's equation has been used to evaluate the effect of the sanded liner on productivity in the range of gravels in common use.

$$\frac{Q}{Q_o} = \frac{R^2 \log_e \frac{r_e}{r_w}}{\delta\left[\frac{2}{3} + \frac{R^2}{2} + \frac{R^2}{\alpha}\log_e \frac{r_e}{r_w} - \frac{4}{\pi^2}\sum_{o}^{\infty} \overline{B_n}\right]}$$

Where,

$$\overline{B_n} = \frac{1}{n^2\left[I_o(n\pi R) + \frac{I_1(n\pi R)\, K_o(n\pi R)}{K_1(n\pi R)}\right]}$$

$\frac{Q}{Q_o}$ = ratio of production through a sanded liner to open-hole production.

r_w = well bore radius in feet.

r_e = drainage radius in feet.

R = ratio of well bore radius to sand thickness.

δ = ratio of permeability of formation sand to the well permeability.

I_o and K_o are zero order Bessel functions of the third kind, and I_1 and K_1 are first order Bessel functions of the third kind.[2]

FIGURE 1. Test apparatus for open-hole gravel pack completion.

Results of this study are shown in Figure 3 where well capacity is plotted as a function of the ratio of formation permeability to well bore permeability. For any given bore radius and drainage radius, the controlling factor in these equations is R, the ratio of well bore radius to sand thickness. For larger values of this ratio; i.e., for thinner sands, the sanded liner effect on well capacity is smaller. At a formation-to-well-bore permeability of 0.001, Q/Q_o for a sand thickness of 25 feet is 0.6, whereas it is 0.9 for a sand thickness of ten feet. From this it may be concluded that a clean, full-hole gravel pack has only a small effect on well capacity for the normal completion intervals encountered in practice.

A further extension of these curves shows that if the permeability in the well is lowered, the well capacity is sharply reduced. This phenomena was noted in radial flow tests involving gravels that were not capable of screening the sand. The curves of Figure 5 show the reduction that occurred with the larger gravels. On cleaning out these packs, only relatively small amounts of sand were found in the gravel. Once a small

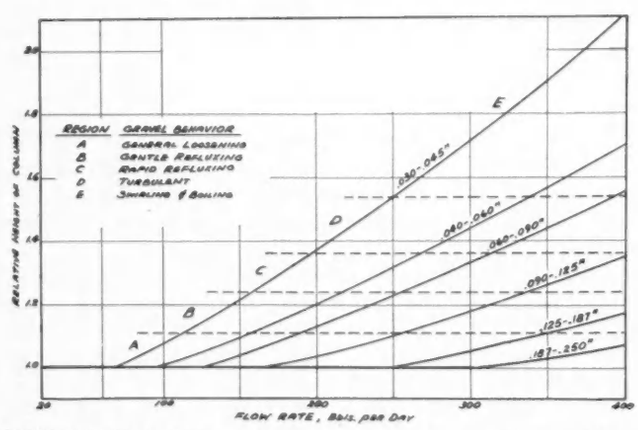

FIGURE 2. Effect of Linear flow on unsupported gravel columns. (Water flow in five-inch lucite pipe. Temperature: 78° F.)

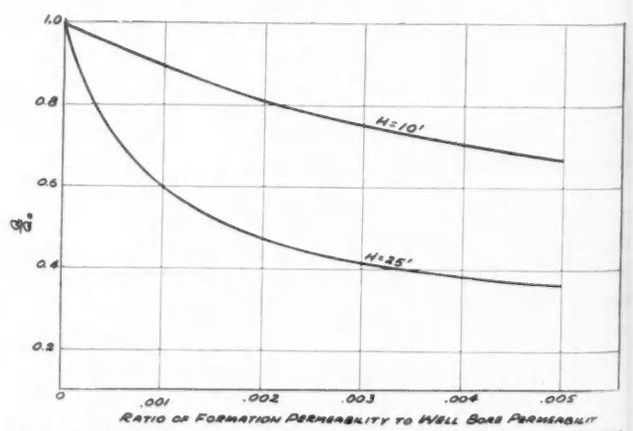

FIGURE 3. Effect of a sanded liner on well capacity. (Data: $r_e = 500'$ $r_w = 025'$)

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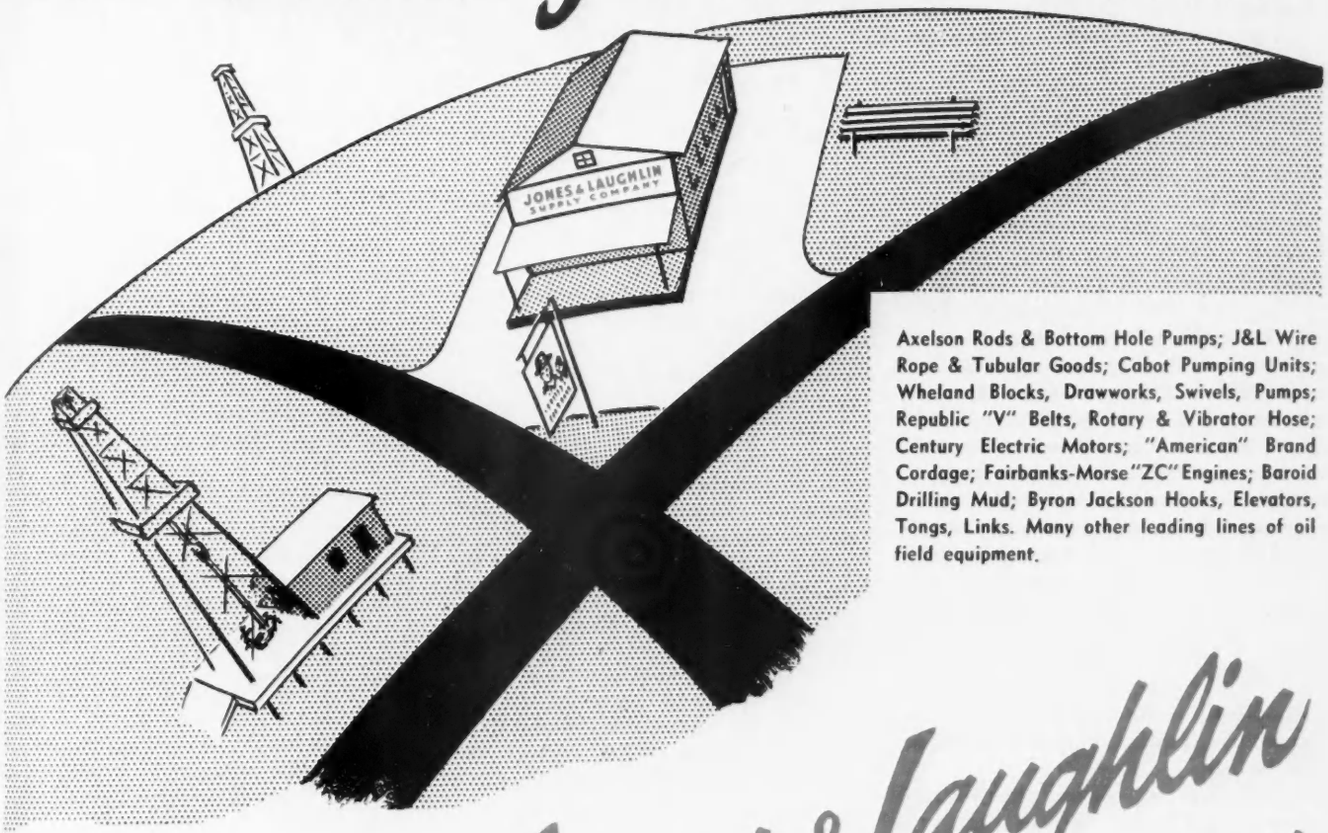

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amount of sanding of a full-hole gravel pack occurs, the operator is positively warned of this fact by sharply curtailed production rates. This effect may well be great enough to prevent any sand from migrating into the tubing before flow is stopped.

Proposed Full-Hole Gravel Pack Technique

As the pressure-drops across the gravel columns were very small (Table I), it was felt that a full-hole pack was possible if a packing element could be devised that would hold the gravel in place and at the same time pack off at the top of the gravel. The setting shown in Figure 4 is believed to satisfy the requirements of a satisfactory full-hole pack.

The bottom assembly consists of a two-cup packer with the lower cup attached to the packer immediately above the bottom coupling. A flat plate equipped with at least 24, one-eighth-inch slots or perforations that will exclude the pea size gravel is screwed into the bottom coupling. A shear-pin type circulation joint is attached above the packer. The string is lowered with the circulation joints open to allow rapid lowering of the string. With this type setting it is doubtful that enough torque could be applied to close the ports of a rotation type circulation joint; the ports of the shear-pin circulation joint are closed by slacking off weight on the tubing which rests on the gravel.

The use of a tubing centralizer above the circulation joint is suggested as a means of minimizing the wear on the rubber cups. A safety joint in the string above the centralizer would provide a means of backing off the tubing should the setting become so sanded up that it could not be pulled.

The entire process requires only two round trips, one to place the gravel and one to set the packer. The following procedure is proposed for making the setting:

- Go in the hole with open ended tubing and wash to bottom. Circulate, preferably with salt water, until returns are clean.
- Squeeze fine gravel through the perforations leaving enough fine gravel in the casing to give a fill-up of six to eight feet above the top perforations.
- Place about two feet of pea size gravel on top of the pack.
- Make a round trip to set the two-cup packer and circulation joint.
- On reaching bottom, slack off tubing to close ports of circulation joint and leave a small amount of weight on the setting to act as a hold-down on the gravel pack.

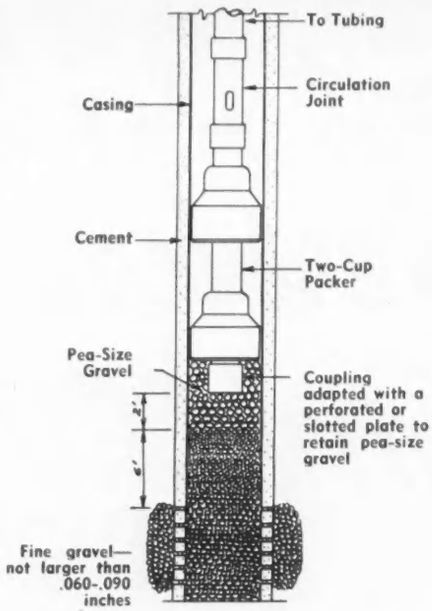

FIGURE 4. Proposed full-hole gravel pack.

The advantages to be realized by this technique: (1) The initial cost is low, as the cost of cup packer and circulation joint are comparable to the conventional hook wall packer. (2) Gravel placement time is a minimum. (3) The cup packer with the perforated plate packs off at the top of the gravel and holds the gravel in place. (4) If the pack sands up, flow will be greatly reduced or stopped altogether before any appreciable sand volume migrates into the tubing. This is due to the sanded liner effect discussed in the previous section. (5) The full-hole pack can be reworked quickly and easily. (6) Should the entire setting become severely sanded up and efforts to wash out the sand through the circulation joint fail, the setting can be readily washed over. (7) There is no liner to fish out if the well has to be reworked.

A series of radial flow tests were conducted in order to determine the performance of the full-hole pack using various gravel sizes. In each case gravel was poured into the casing to a point about 15 inches above the top perforations. The top four inches of each pack contained pea size gravel. A rubber cementing plug equipped with a perforated disk to screen the pea gravel was placed on top of the gravel pack. Lead weights were dropped on top of the rubber plug to hold the gravel in place.

TABLE 2

Sieve Analysis, 3600-Foot Sand, Leeville Field, Louisiana

Screen Size	Weight Percent	Cumulative Weight Percent
35 Mesh (.0164")	0.4	0.4
48 Mesh (.0116")	4.4	4.8
65 Mesh (.0082")	35.7	40.5
80 Mesh (.0069")	17.8	58.3
100 Mesh (.0058")	15.9	74.2
150 Mesh (.0041")	13.6	87.8
On Pan	11.0	98.8

Sand packed in the reservoir was sand produced from a well in the Leeville field. The sieve analysis of this sand is shown in Table 2. The connate water of the sand was approximately 17 percent. The fluid used in these flow tests was kerosine having a viscosity of 2.22 centipoises. The permeability of the sand as packed was measured to be 6.9 darcys to oil flow.

Figure 5 is a composite plot of the results of this series of tests. To place all tests on a comparable basis the ordinate Q/Q_1, which is the ratio of the productivity of the system at a particular time to the initial productivity of the system, was plotted versus time. The sharp break in each curve is at the point where the drawdown of the eyetem was increased from about 55 to 65 pounds per square inch. Evidently, the slightly higher velocities thus created carried additional amounts of sand into the pack before stable bridges formed at the new flow rate.

From the productivity declines, it can be seen that only the fine gravels (0.040-0.060 and 0.060-0.090 inches) effectively screened the sand. When the packs containing the fine gravels were cleaned out, there was no evidence of sand; whereas, varying amounts of sand were noticeable with the larger size gravels. These tests conclusively point out the necessity of using fine gravels with the full-hole pack. Even a small degree of sand invasion has a marked effect on the capacity as evidenced by the curve for the 0.090-0.125-inch gravel.

Two series of radial flow tests were conducted to check the effect of perforations filled with formation sand rather than gravel. After 50 hours of flowing through 0.040-0.060-inch gravel with sanded perforations, i.e., gravel only inside the casing, the specific productivity of the system was 0.130 barrels per day per pound per square inch per foot of sand. When 0.040-0.060-inch gravel was packed into the perforations, the specific productivity was 0.195 after 50 hours, an increase of 50 percent. On running the system for 70 hours with 0.090-0.125-inch gravel in the casing and sand in the perforations, the specific productivity was 0.080 barrels per day per square inch per foot of sand. The productivity of the system with 0.090-0.125-inch gravel packed in the

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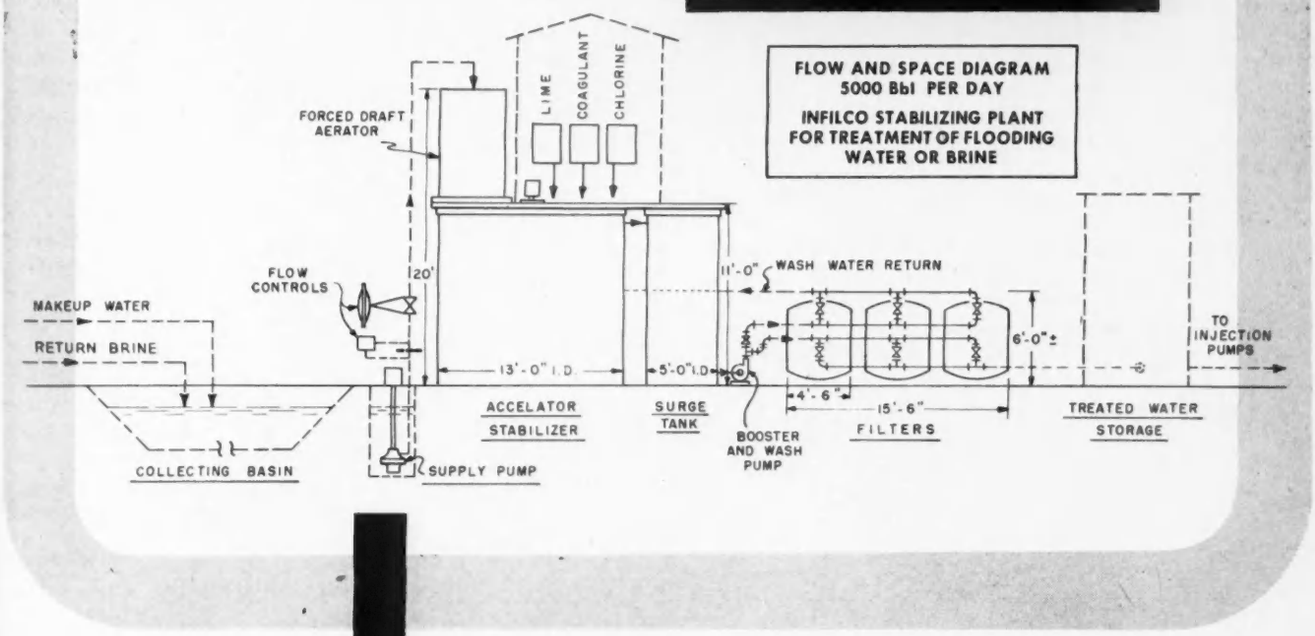

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perforations was 0.096, an increase of 20 percent in productivity.

The greater increase obtained with the 0.040-0.060-gravel is attributed to three factors: First, this size gravel more effectively screened the sand. Second, the investigators were able to better pack the perforations with the 0.040-0.060-inch gravel than with the 0.090-0.125-inch gravel. Third, the perforations were only packed a little more than half their length with the 0.090-0.125-inch gravel, whereas with the 0.040-0.060-inch gravel the entire length of perforations was completely filled.

The significance of these tests is that sanded perforations do adversely affect the productivities where the screening material is confined to inside the casing. The degree of this effect depends upon the physical parameters of each well; therefore, the values reported above are not presumed to be the expected differences in field wells. Also, the value of gravel placement beyond the perforations is obvious.

To study the effect of water influx on sanding, the casing and perforations were packed with 0.090-0.125-inch gravel. This size was selected for it was known from previous tests that it did not entirely screen the sand, but that the productivity did stabilize in a short time after a small initial decline. Kerosine was flowed for 12 hours to allow the productivity to stabilize. When the flow was changed to fresh water, the productivity of the system dropped precipitously as water production commenced (Figure 6). The test was carried beyond the indicated time of 23 hours; however, at that time a bacterial growth was noticed in the flow stream, and later readings were undoubtedly affected by that growth.

Considerably more sand was found in the pack after this run than had been found on previous runs when only kerosine was flowed through a pack of 0.090-0.125-inch gravel. The influx of water definitely carried large amounts of the unconsolidated sand into the pack which were not carried by the kerosine. Flow rates obtainable with water were less than with kerosine; so fluid velocity in this case is of lesser importance than other factors.

Factors, other than increased sanding, that affect the productivity when water floods an oil sand are the viscosity of water and the permeability to water flow. The viscosity of water is only about one-half that of kerosine, which tends to give higher productivities. However, the permeability to water flow of a water-flooded oil sand is considerably less than the permeability to oil of an oil-saturated sand, which lowers the productivity. These two effects are compensating; therefore, it may be concluded that the sharply reduced productivities are due mainly to sanding of the pack, obviously the result of water influx.

The operator has no way of knowing if or when water production will begin. While the larger gravels may be satisfactory as long as clean oil is produced, it appears that the best course then is to use the finer gravels which effectively screen the sand under all conditions.

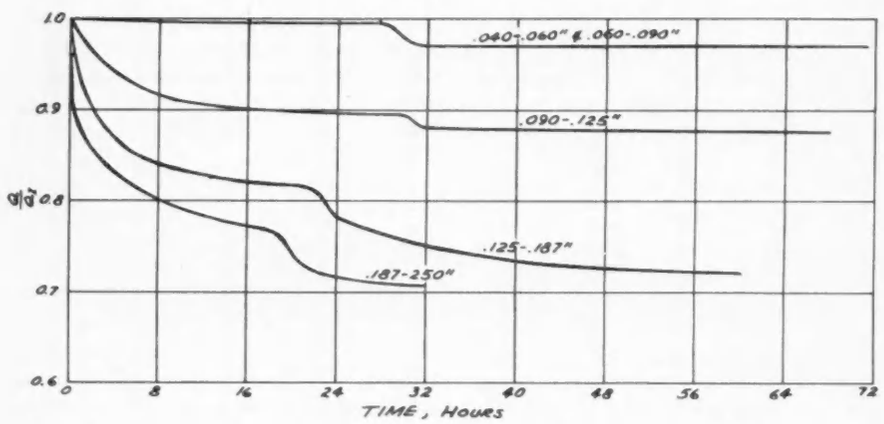

FIGURE 5. Gravel size—productivity relationship—of the full-hole gravel pack. Fluid: kerosine.

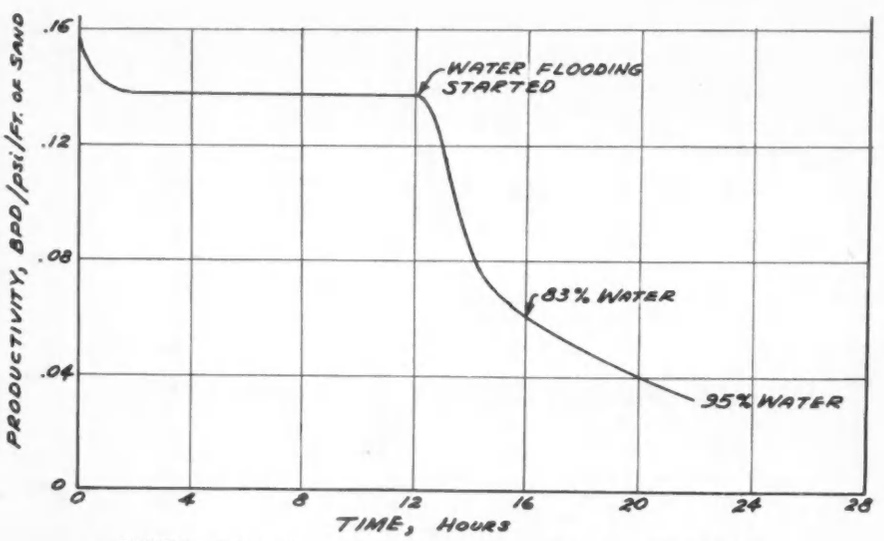

FIGURE 6. Effect of water influx on sanding. Gravel size: .090 — .125".

Summary and Conclusions

Linear flow tests through gravels point out the necessity of mechanically holding a full-hole gravel pack setting in place. The proposed setting satisfies this requirement as well as packs off the casing at the top of the gravel. The main difficulty of working over conventional gravel pack settings has been eliminated in this new technique, as no liner is set.

Only the finer gravels, not larger than 0.060-0.090 inches, should be used in the perforated interval as evidenced by radial flow tests conducted with the full-hole pack. The presence of sand in the perforations yields low well productivities which should be prevented by squeezing gravel outside the casing.

The full-hole pack is a form of a sanded liner which inherently lowers well productivity; however, the permeabilities of clean gravels are so great that the reduction in productivity due to this effect is negligible. If gravel is squeezed through the perforations, the success of the full-hole pack should not be materially different from that of the normal two-stage gravel pack. The satisfactory tests conducted with the full-hole pack encourage its trial in oil wells, so that its practical utility may be ascertained.

ACKNOWLEDGMENTS

The writers wish to express appreciation to the Petroleum Engineering department of Louisiana State University for cooperation in this study, to the Latex Gulf Oil Company for furnishing the oil sands, and to Layne and Bowler Company for furnishing the gravels.

REFERENCES

[1] Muskat, M.: *Physical Principles of Oil Production;* McGraw-Hill (New York), 1949, pp. 255-259.

[2] Watson, G. N.: *A Treatsie on the Theory of Bessel Functions;* McMillan (New York), 1944, Tables—pp. 698-713.

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Deep Zone Flooding in Arkansas

By STERLING S. LACY, JR.

McAlester Fuel Company, Magnolia, Ark.

FACED WITH a drastic cut in allowables due to a drop of almost half of the original bottom-hole pressure of 1299 pounds, operators in the Wesson field of Arkansas completely unitized the field and source of water supply to bring the reservoir pressure back to almost original pressure in about three years. Central tank batteries were erected and an unusual water-flood system was installed. Production history of the field is reviewed and details of the field operation are presented.

APPLICATION of new engineering techniques, and agreements between operators and landowners on unitization of a common source of supply, have made it possible to successfully water flood comparatively deep horizons. An outstanding example is the success achieved in water-flooding the 3150-foot Hogg sand in the Wesson field, Ouachita County, Arkansas, where it is estimated that the recovery of 18,775,000 barrels of oil, in excess of the 11,410,000 barrels recovery expected by primary production methods, will ultimately be realized under the unitized flooding program.

The Hogg sand, which was formed as a submarine bar during Lower Cretaceous time, is classified as part of the Basal Pine Island formation. Though it is highly porous and permeable, this sand quickly grades to shale at the edges of the reservoir and is limey near its base. A Lower cretaceous fault with approximately 180 feet of displacement formed the trap favorable for oil accumulation. This fault is the northeast boundary of the reservoir and the narrow sand bar extends more than five miles in a southwesterly direction to the oil-water contact. In the highest structural well near the fault, top of the sand is 223 feet above the original oil-water contact. The productive area, covering 1540 surface acres, is calculated to have originally contained 30,185 productive acre feet of saturated sand.

The Hogg sand was initially proven productive in McAlster Fuel Company's R. W. Wesson A-1, C NW¼ NW¼ SE¼, 24-15s-19w. Ouachita County, Arkansas. This well was completed January 24, 1946, through perforations from 3085-102 feet and flowed 246 barrels of 33-degree gravity oil through a 13/64-inch choke with 200 pounds per square inch tubing pressure. The original gas-oil ratio was estimated to be 100 cubic feet of gas per barrel of stock tank oil.

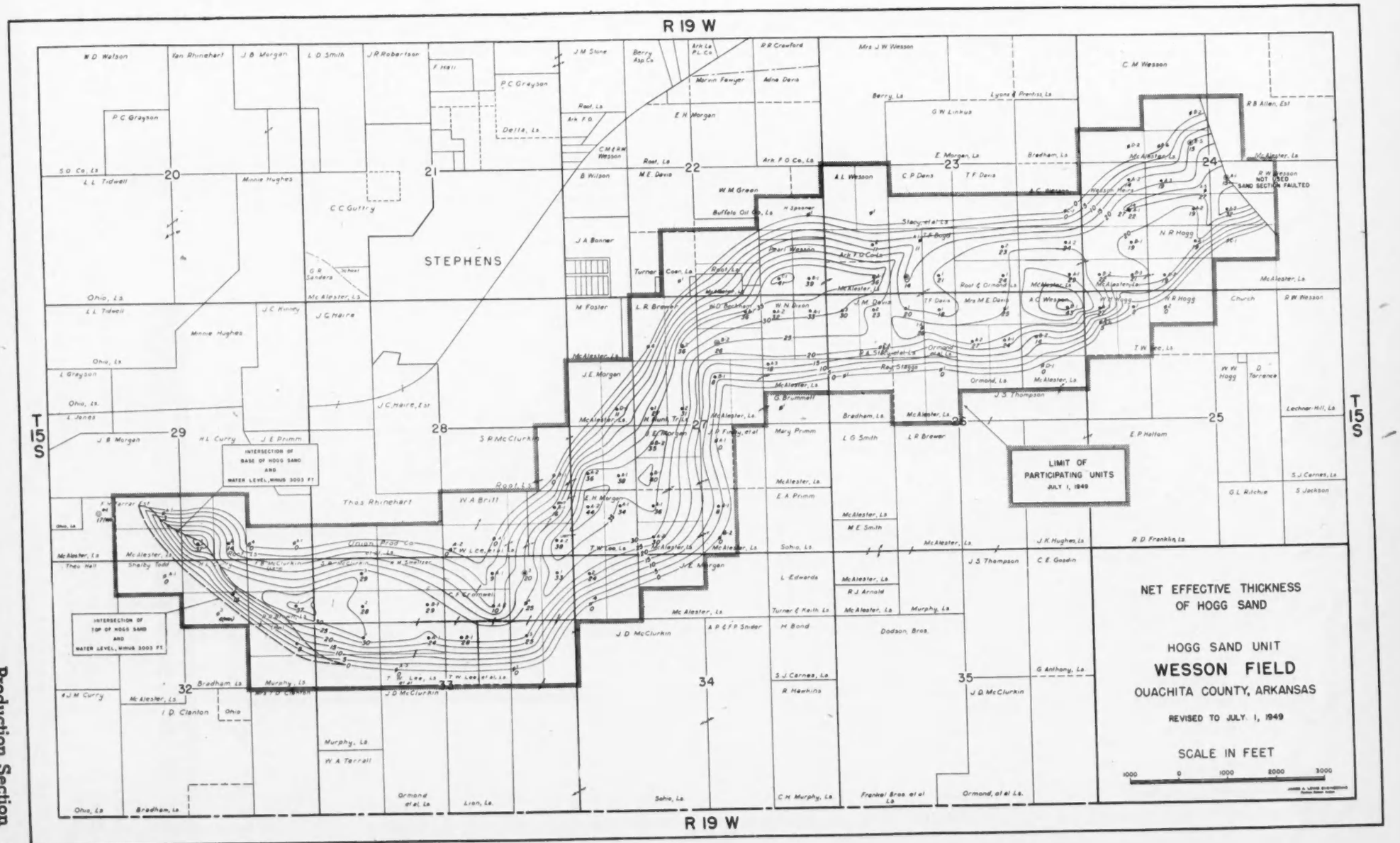
Early development on a 20-acre spacing pattern centered around the southwest quarter of Sec. 24. During the first eight months of operation only 112,170 barrels of oil were produced from ten wells by natural flow before the rapidly declining bottom-hole pressure necessitated artificial lift.

A well allowable of 100 barrels per day remained in force for 18 months until September 1, 1947, when it was reduced to 75 barrels per day because of the continuing rapid decline in bottom-hole pressure. The production of 689,816 barrels of oil caused a drop of 645 pounds per square inch from the original pressure of 1299 pounds per square inch measured on a sand base datum. Early analysis of reservoir data indicated that oil production was being obtained primarily by fluid expansion, since no free gas cap existed and the rapid decline in bottom-hole pressure proved that no effective water drive existed. Development progressed slowly to the southwest until Lee and Burnett's wildcat discovery located more than 1¼ miles southwest of proven production, touched off rapid exploration which climaxed development in the fall of 1947. By the fall of 1948 the oil-water contact had been reached, thus virtually defining the reservoir except for adjustments of sand thickness in selected areas.

Based on available core data, the Hogg sand has an average porosity of 32 percent, an average permeability of 2770 millidarcys, and an average thickness of 24 net feet of sand. Field rules established by the Arkansas Oil and Gas Commission required the setting of approximately 100 feet of surface casing. Rotary equipment and native mud were used to drill a nine-inch hole through the sand. A good many wells were cored with conventional core barrels and hard formation cutter heads; however, core recoveries were disappointing, resulting in incomplete core analysis data. It was a peculiar characteristic of the pay interval to show very little change in drilling or coring time. After the electric log was run, 5½- or seven-inch casing was set through the sand and cemented by the pump and plug method. Because of the proposed gas injection program, the majority of the wells were completed by gun perforating the lower part of the sand.

During the early productive life of the field the need of pressure maintenance for the reservoir was realized, and plans were made for a gas injection program to serve the 11 wells then producing from the sand. Subsequent development proving additional area together with delay in delivery of compressor equipment interrupted the initial plan, but the operators began holding meetings in August, 1947, to discuss unitization for pressure maintenance. The operators appointed an engineering committee with instructions to assemble pertinent data and also commissioned an engineering consultant to make a study of the reservoir to determine which of two media, gas or water, would be the most efficient and economical flushing medium. It was reported in December, 1947, that: (1) a recovery of 378 barrels per acre foot could be expected by natural depletion; (2) gas injection would increase recovery to 800 barrels per acre foot; and (3) water injection should recover 1000 barrels per acre foot.

On June 15, 1948, the operators appeared before the Arkansas Oil and


R 19 W
T 15 S
STEPHENS
LIMIT OF PARTICIPATING UNITS JULY 1, 1949
INTERSECTION OF BASE OF HOGG SAND AND WATER LEVEL, MINUS 3003 FT.
INTERSECTION OF TOP OF HOGG SAND AND WATER LEVEL, MINUS 3003 FT.
NET EFFECTIVE THICKNESS OF HOGG SAND
HOGG SAND UNIT
WESSON FIELD
OUACHITA COUNTY, ARKANSAS
REVISED TO JULY 1, 1949
SCALE IN FEET
1000 0 1000 2000 3000

Field map of the Wesson field showing outline of productive area. Fault block is at upper right.

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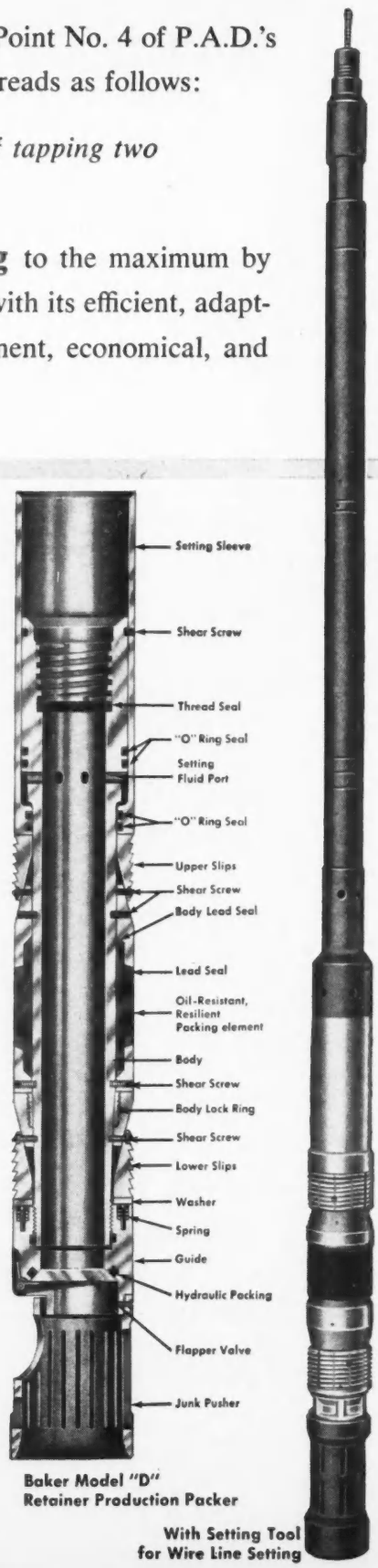

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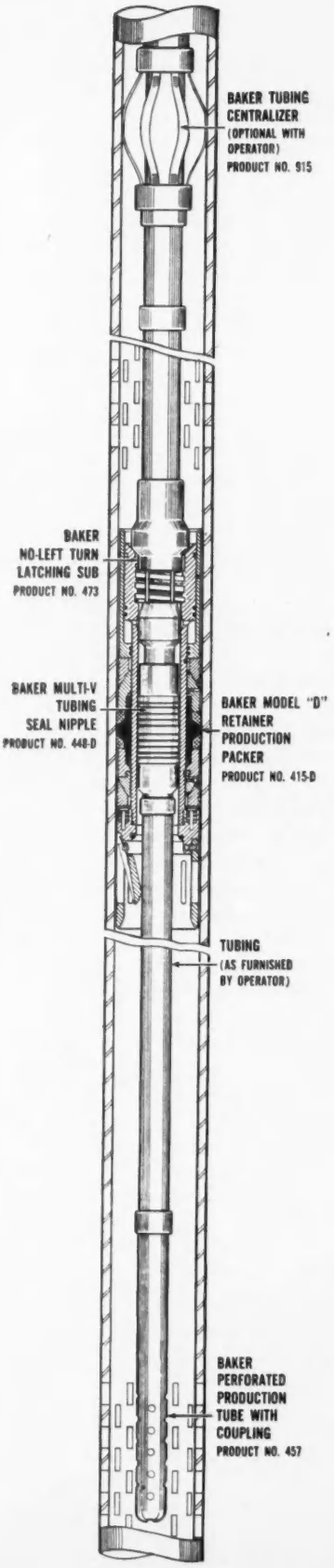
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LEFT—This *one-packer* hook-up provides a means of producing two zones at the same time, the *lower* zone being produced through the tubing, and the *upper* zone through the annulus between the tubing and the casing. Such a dual-zone installation is used where:

1. It is necessary to *pump* the *lower* zone. The tubing may be anchored to the packer to prevent movement of the tubing during the pumping cycle which will allow for increased plunger travel.

2. With *both* zones flowing, the differential pressure across the packer (from below) is greater than 2000 psi.

3. It is necessary to produce the *lower* zone, and inject water or gas from the surface into the *upper* zone.

4. The *upper* zone is produced through the annulus between the tubing and the casing, while water or gas is pumped down the tubing into the *lower* zone.

RIGHT—This dual-zone hook-up is designed primarily to permit *pumping* the *upper* zone and *flowing* the *lower* zone. Two Baker Retainer Production Packers, an Anchor-Type Change-Over Flow Tube and other Accessory Equipment are required. The *lower* packer is set *just below* the *upper* zone in order to prevent an excessive amount of sand from settling on top of the packer. The *upper* packer is set immediately above the *upper* zone, and continuous isolation of the zones is maintained.

The tubing string is held in tension for efficient pumping; the pump can be pulled for re-placement of parts, the *lower* zone meanwhile remaining isolated; provision is made for washing out sand or settlings to facilitate removal of the production string. In fact, nothing is lacking to provide flexibility of operation, combined with efficient, low-cost, permanent, dual-zone production.

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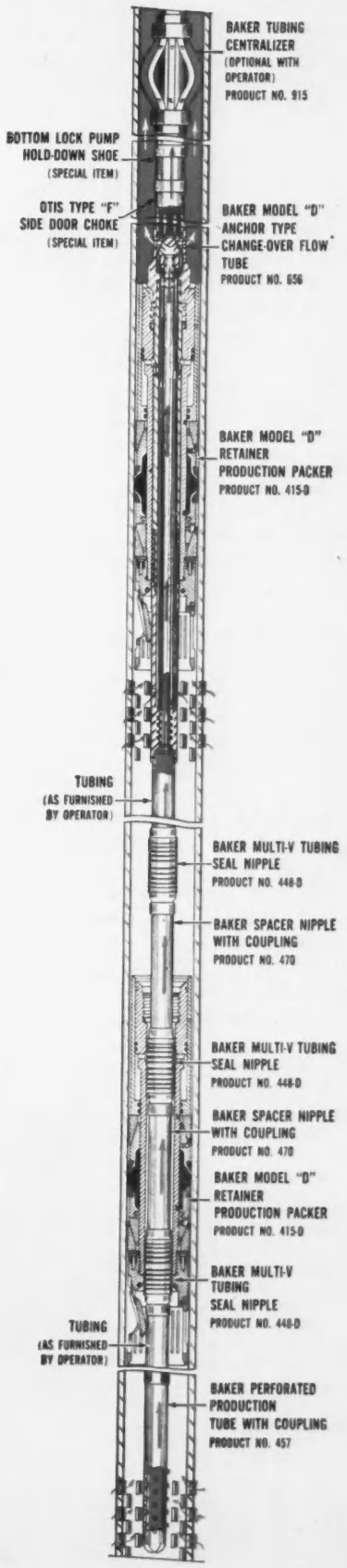
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SIMPLIFY PRODUCTION PROGRAMS

Gas Commission and presented evidence showing that 100 percent of the owners of working interest had signed the Unitization and Pressure Maintenance Agreement and that approximately 77 percent of the royalty owners had signed the Royalty Pooling Agreement. These documents were approved to become effective July 1, 1948, and McAlester Fuel Company, as appointed operator, assumed operation of the 60 producing wells in the unitized area.

On October 1 of that year the productive acreage of the unit was expanded by eight wells completed in August and September. Most of these were completed after the beginning of unit operation.

Under the utilization agreement, any operator who believed his tract contained more than the assigned productive acre feet could drill a slim hole or core test to prove or disprove the allocated sand thickness. Six different operators drilled 11 core tests during the first year, seven of which resulted in gains for operators. The reservoir was considered defined on July 1, 1949.

About the Author

STERLING S. LACY, JR., graduated from Texas A. & M. College in 1947 with a B.S. degree in petroleum engineering. He was employed by McAlester Fuel Co. in May, 1947, following his release from the U. S. Army. He worked first as a roustabout and roughneck on company drilling rigs until his return to school for his senior year. After graduation, he was employed as field engineer and is now working as an engineer for McAlester Fuel Company.

Unit Operation

To inaugurate the desired program as quickly as possible, several major phases of the over-all project were outlined as follow: (1) development of adequate water supply; (2) early installation of a centrally located water station and injection system; (3) consolidation of existing storage facilities into five conveniently located batteries; (4) a gravity gathering system; (5) a unit road system; (6) a unit gas system; and (7) the compilation of accurate engineering data, including additional bottom-hole pressure measurements, gas-oil ratios, productivity indices, complete gas, oil, and water production data together with injection volumes and pressures.

Development of Water Supply: Since an adequate source of fresh water was not available, salt water was selected as the flooding medium. The Nacatoch horizon, which occurs at approximately 1500 feet, was the first major salt water sand. This blanket sand, approximately 180 feet thick, offered the most favorable possibility for development. After an unsuccessful attempt to recomplete a dry hole, a new well was begun. A 12¼-inch hole was drilled to 1700 feet; 9⅝-inch casing was set and cemented on bottom with 300 sacks of cement. A sand section seven feet thick was then exposed by gun perforation with ten shots per foot. A two-batch plastic squeeze job was performed prior to any production in order to consolidate the loosely cemented fine sand. After swabbing had indicated the well to be sand-free, a large volume pump powered by a 52½-horsepower electric motor, was run on three-inch tubing. A week of testing proved the well capable of producing in excess of 5000 barrels per day of sand-free water.

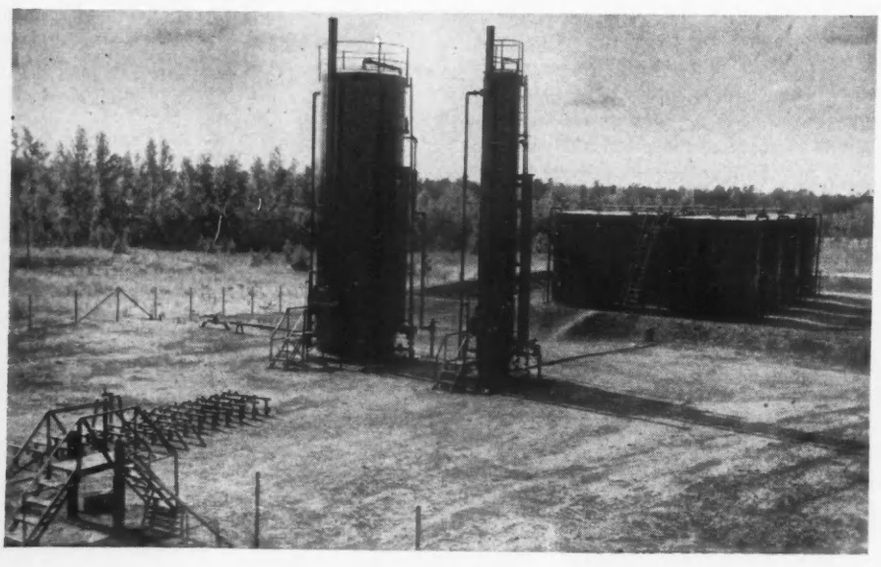
A second water supply well was drilled approximately 1300 feet from the first and completed in the same manner, except that two sections of sand, each seven feet thick, were opened and consolidated in an effort to develop a well of greater capacity. This well was equipped with four-inch tubing and a 97½-horsepower pump. Testing proved this well capable of producing in excess of 7500 barrels per day.

A third water supply well was obtained by successfully recompleting a former producing oil well. The Hogg sand interval was plugged off and 19 feet of the Tokio sand, which occurs at approximately 2400 feet, was opened by gun perforation. A shaft-driven turbine pump was set at 400 feet. This Tokio supply well is capable of producing approximately 3000 barrels per day.

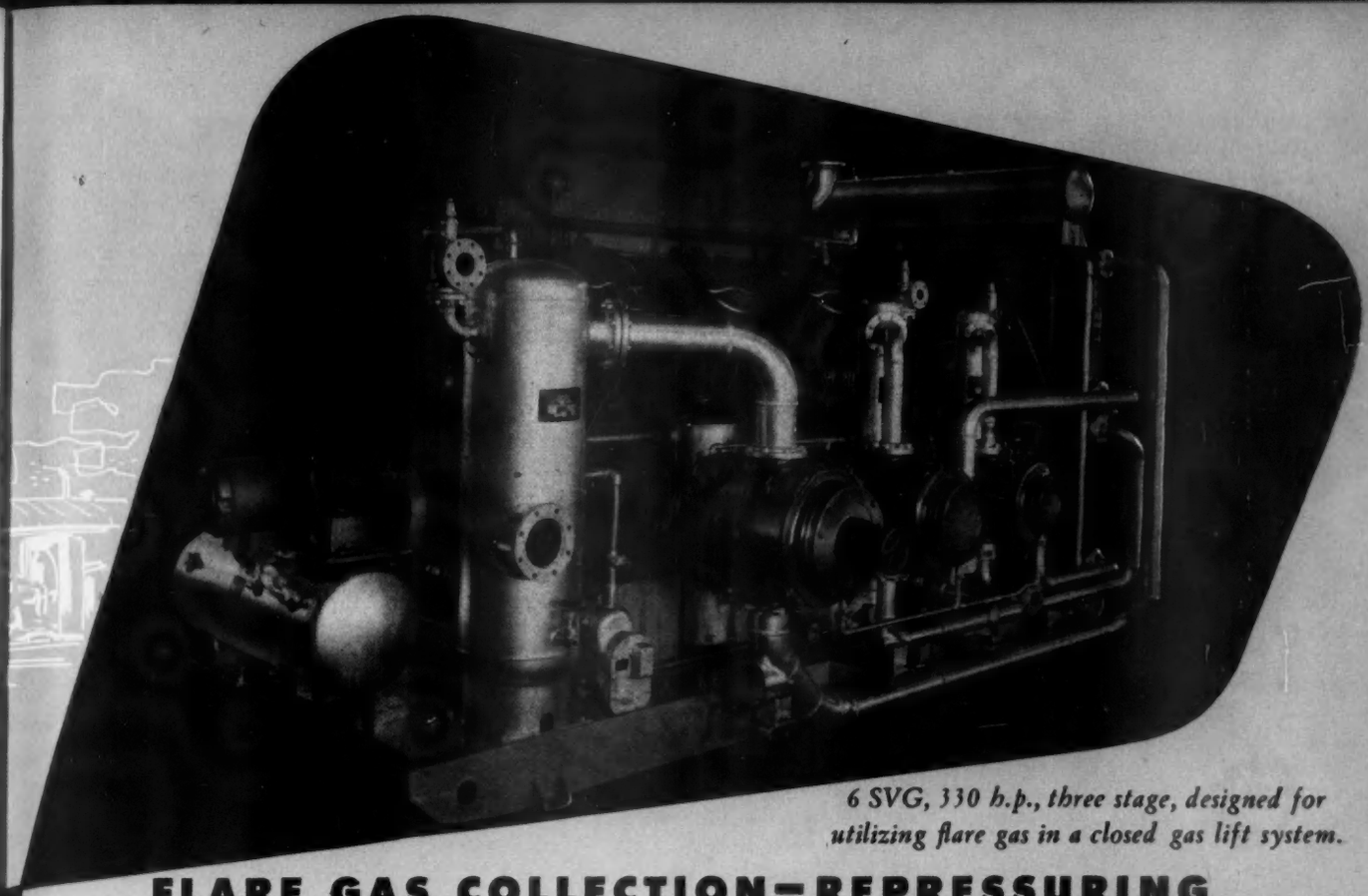
Temporary Injection System: Following the completion of the first water supply well, temporary three- and four-inch lines were laid to two nearby producing wells selected for conversion to water injection wells. The injection wells were prepared by perforating the entire pay interval and injecting water through the tubing. Unit Wells 36 and 55 were selected because they were thought to be located in bottleneck areas. The plan for the flood pattern was to inject water into the more narrow portions of the reservoir, draw the water to each edge and then move a wall of water down the axis of the reservoir, forcing the oil ahead.

Due to the scarcity of tubular products, installation of the permanent injection system was delayed; however, the urgent need of injecting additional water necessitated extension of the temporary system to two additional injection wells. By January, 1949, water was being injected into five wells in five different reservoir areas.

Injection Plant Equipment: A reciprocating pump was installed, equipped with bronze valves, rods,



View of consolidated battery "A" (rear); large and small heater-treaters (center) and the flow line manifold at lower left.



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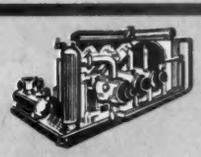

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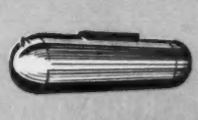
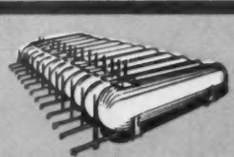


ANHYDROUS AMMONIA EQUIPMENT



PRESSURE BULK STORAGE

seats, and liners to resist the corrosive action of the salt water. This temporary injection pump was powered by a 125-horsepower engine, which utilized natural gas as fuel. Two 10x20-foot vertical filters were installed to filter all water prior to injection, and two horizontal 10x20-foot accumulator tanks were erected to backwash the filters. These tanks were provided with gas blankets to prevent the water from coming into contact with air, thus maintaining a closed system. Previous analyses of the Nacatoch water revealed a potential precipitate of 13 pounds of iron per 100 barrels of water if the water were aerated; however, since the iron was in the ferrous state, it would remain in solution if kept from contact with air. Also, the gas blanket on the filters has provided more flexibility in the system. By maintaining a pressure differential on the two vessels it is possible to exceed the designed capacity of the filters, since the water produced by the supply wells is clean and does not tend to plug the sand face of the filters. The filters are backwashed once each week, but no great amount of sediment has ever been recovered by backwashing.

A six-stage centrifugal pump was installed as a permanent injection pump. This cast bronze pump, powered by a 300-horsepower electric motor, can handle 18,000 barrels per day operating under 750 pounds per square inch pressure. The reciprocating powered pump has been retained for standby service in the event of electrical power difficulties or failure of the centrifugal pump. Electrical float switches have been installed on the accumulator tanks, which could shut down either injection pump or the water supply wells. Also, an electric pressure switch, sensitive to a drop in normal line pressure, will be used to shut down either injection pump in the event of a break in the injection system.

A 20,000-barrel welded steel tank was erected to store produced water so that the injection system could still operate in the event of water supply or electrical power failure. Two 3 x 4-inch centrifugal booster pumps pull water from the storage tank or gravity gathering lines and deliver the water to the filters. One pump is operated by a 7.5-horsepower electric motor, and the other pump, a standby, is powered by a combination natural gas or gasoline engine.

Permanent Injection System: The permanent injection system was designed for a maximum working pressure of 750 pounds per square inch, and line sizes were calculated to give minimum friction loss. Cement lined steel pipe was used to withstand interior corrosion caused by the salt water. The outside of the pipe was covered with a protective pipe coating to minimize exterior corrosion. Seven-inch cement lined pipe extends from the plant east to Well 36 and west to Well 55. The line size then becomes progressively smaller (from five-inch to three-inch) as the volume of water to be handled decreases.

Two-inch high pressure water meters measure the injected water at each input well. Meter loops, which provide a bypass for the meter, are also used to control the volume of injected water. These meter loops have been standardized in length, and a spare loop is held in reserve.

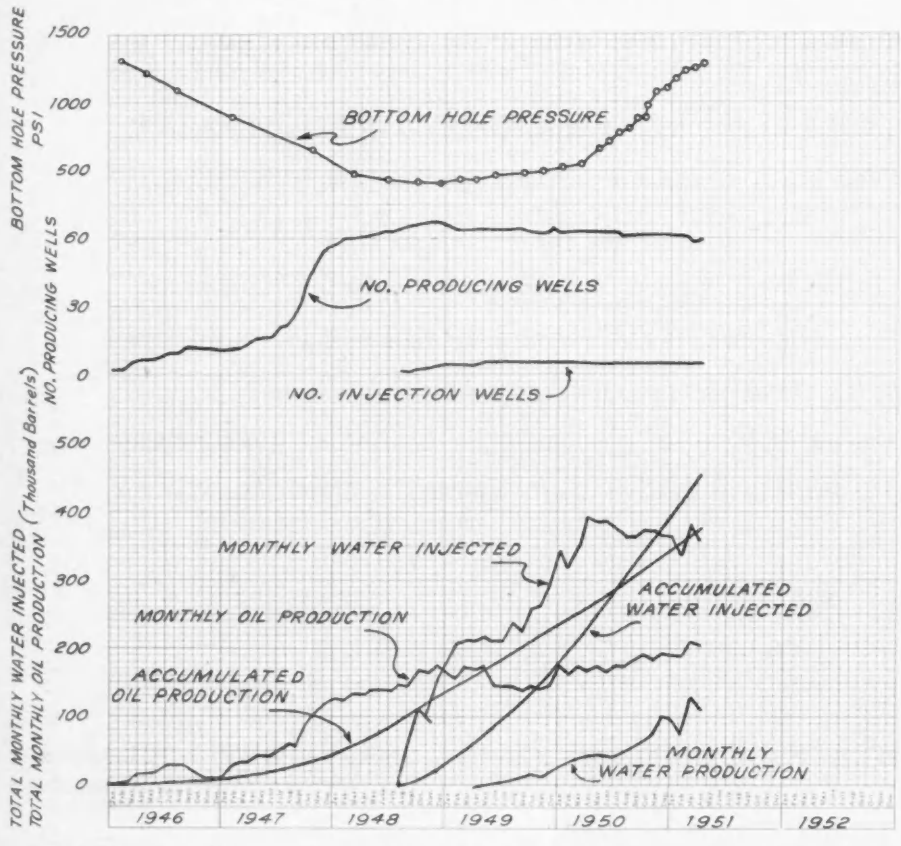
Water injection rates are based on the volume of the reservoir served by each injection well. The volume of water injected exceeds that of the oil, water, and gas withdrawals from any area. Injection rates vary from 750 to 3200 barrels per day per well when the total daily injection is 12,000 barrels per day.

The average volume of daily water injected has increased from 2271 barrels per day in September, 1948, to 12,149 barrels per day, an average for the year 1950. Oil production during April, 1951, averaged 6996 barrels per day. Water injection in excess of reservoir withdrawals will be maintained to increase the bottom-hole pressure to 1500 pounds per square inch so that the wells will return to natural flow.

It is estimated that a coverage of 75 percent of the reservoir will be obtained by the flood pattern even though there are many edge locations which have not been drilled. It is calculated that 74 percent of the reservoir volume lies within the limits of the 20-foot isopach line. Additional edge wells will be drilled to give maximum coverage of the reservoir upon the accumulation of sufficient data to properly locate such wells.

Consolidated Tank Batteries: Prior to unit operation approximately 40 sets of tank batteries served 68 producing wells. Consolidation of tank batteries was commenced in order to (1) reduce production costs, (2) minimize the number of treater installations, and (3) facilitate gathering of produced water. Five locations at points of high elevation in the field were selected as sites for the consolidated batteries.

Consolidation of batteries began with Unit Battery "D," where four additional tanks were moved intact from various leases and combined with four high 500-barrel bolted steel tanks already in use. To prevent interruption in the normal production schedule only one tank was moved from each lease battery. After the first battery was completed all material sal-



Statistical data on the Wesson Hogg Sand Unit since the field was discovered early in 1946. Note increase in bottom-hole pressure and daily oil production.

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vaged from the consolidation was used to begin work on the next battery.

Individual flow lines from all wells in the area were laid to a common header in the battery. Each header was made to serve approximately 15 wells, provision being made for additional wells which might be completed at later dates. The header provides a method of switching any well to an individual treater for a well test while all other wells are producing into the large treater. At each battery, two treaters were installed for gas, water and oil separation. The individual test treaters, 4 x 28 feet, are each equipped with five-eights-inch hot water meters to measure the water produced. Positive displacement gas meters are being used to measure gas production. Risers to the tanks are equipped with valves so that any one of the eight tanks may be used for individual well tests. Continuous tests are conducted in each battery, and at least one test is run on every producing well each month.

The 10 x 28-foot treater at each battery is capable of separating simultaneously all water, oil and gas produced by 15 wells. Water separated from the oil is measured by two-inch hot water meters at each battery before it enters the gravity return system. Oil may be produced into any one or all of the eight tanks.

A small circulating pump at each battery takes suction from the tanks and discharges to the large treater. This pump can serve a threefold purpose: (1) Circulating a bad tank of oil back through the treater; (2) circulating tank bottoms back through the treater to minimize tank cleaning; and (3) drawing oil from below the pipe line connections in several tanks, pumping it into one tank to be run. To date no tanks have had to be cleaned in the unitized batteries because of bad tank bottoms.

Gravity Gathering System: Injected water which is produced with the oil is separated by the treaters of the consolidated batteries and returned to the injection plant for filtration and reinjection. This water is returned through approximately five miles of four-inch and six-inch asbestos-cement pipe. Since all five consolidated batteries are located on points of high elevation, a complete gravity system is employed to return the water to the filters, eliminating the cost of pumping.

Cycling the produced water will (1) reduce the amount of supply water necessary, and (2) solve the problem of salt water disposal.

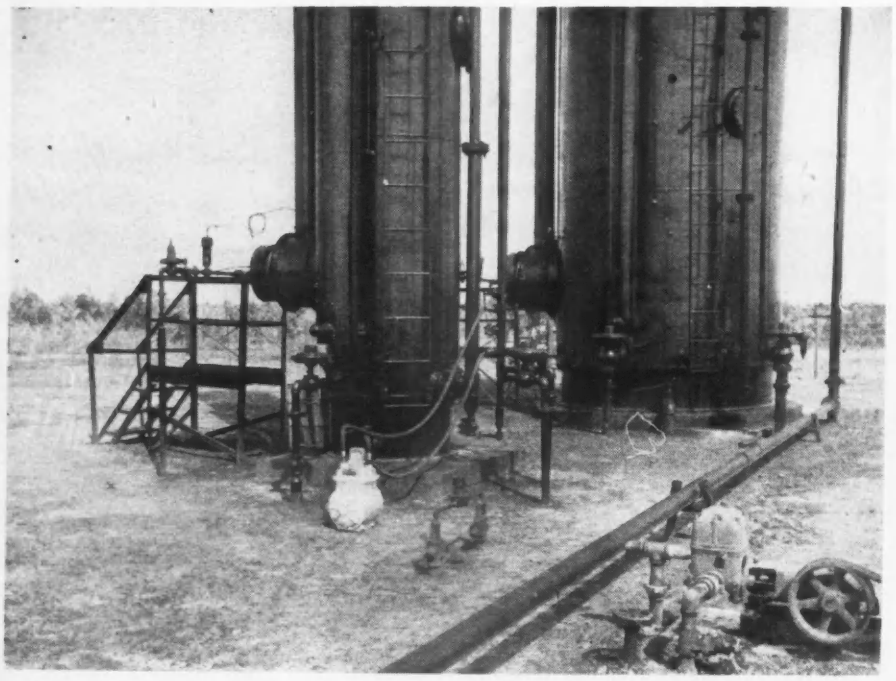
Unit Road System: In order to make each well accessible during the winter months, all-weather roads were constructed to the majority of the unit wells. Ramps for a pulling unit and turn-arounds were also added. Certain leases, which are in low areas, would have been virtually inaccessible during inclement weather.

Unit Gas System: At the beginning of unit operations, each well utilized its produced gas as fuel for the pumping engines. In addition to making it virtually impossible to obtain accurate gas-oil ratio measurements, this arrangement caused considerable downtime for the wells because of an inadequate gas supply. A field gas system connecting the five consolidated batteries was extended to each producing well. This system provides a common supply of fuel gas to the unit wells and has resulted in very satisfactory operation.

Extraneous Gas: After the reservoir pressure had declined below 700 pounds per square inch, increasing gas-oil ratios were observed in the highest structural wells. As the pressure further declined it was thought that gas was breaking out of solution from the oil, but a bottom-hole sample analysis showed that 364 pounds per square inch was saturation pressure for the crude, a point to which the pressure was never allowed to decline. Further investigation revealed that the James lime was thrown opposite the Hogg sand by the fault on the northeast end of the reservoir. The James lime, tested in wells near the fault, was found to carry a high pressure gas. It is now assumed that the extraneous gas was entering the reservoir through the fault plane. The effects of this extraneous gas were first observed in Unit Well 3, when it resumed natural flow after having been on beam pump for nearly a year. Soon other wells in the area adjacent to the fault showed the effects of the gas. Unit Well 13 began uncontrolled flow through the casing, producing several hundred barrels of oil before again being brought under control. Similarly, Well 14 was being pumped with the casing valve open, and gas caused the well to flow through the annulus. Other wells in this area which have at some time resumed natural flow are Nos. 2, 4, 6 and 15. Gas-oil ratio tests revealed that these wells began flowing after exceeding a ratio of 650 cubic feet of gas per barrel of oil.

Bottom-hole sample data shows that the oil contains only 65 cubic feet of gas in solution per barrel of stock tank oil. All gas produced in excess of this amount is classified as extraneous gas. The effect of this extraneous gas has been felt as far down the reservoir as Battery "C."

Entrance of extraneous gas into the reservoir served somewhat to retard the rapid decline in bottom-hole pressure, but it is felt to be harmful to the reservoir under the water-flood program. The extraneous gas created a partial gas cap in certain areas and retarded the fast buildup in bottom-hole pressure expected from water injection. The major harm expected from the gas is water channeling due to the difference in relative permeabilities of the sand to oil and gas.



Base of treaters on consolidated tank batteries. In front of the small treater is a gas meter used to obtain data in computing gas-oil ratios. The water meter is shown at right of gas meter, and small circulating pump is at extreme right.

Water injection into Wells 1 and 3, which are near the fault, has now blocked the entrance of additional gas.

Results Obtained by Water Injection

Water injection halted the bottom-hole pressure decline in January, 1949. At that time the total production of 2,701,537 barrels of oil had reduced the pressure by 887 pounds per square inch to a low of 412 pounds per square inch. At the time of the last pressure survey on May 1, 1951, injection of 9,094,682 barrels of salt water had increased the pressure a total of 870 pounds per square inch. The present pressure of 1272 pounds per square inch is only 17 pounds per square inch below the original reservoir pressure. Now all water free wells will flow their allowable production.

In recognition of the benefits of water flooding, the Arkansas Oil and Gas Commission has granted three increases in allowable. Since December, 1949, the daily allowable oil production for the unit has been increased from 4857 to 6996 barrels per day.

The beneficial effect of water flooding has been clearly evident in Wells 11 and 65. During the last six months of 1949, the daily average oil production from Well 11 amounted to 21 barrels per day. The daily average oil production for 1951 has been 132 barrels per day, which represents a 529 percent increase in oil production. During the first ten months following completion, Well 65 was not capable of producing the assigned allowable of 75 barrels per day; however, since water injection was commenced in Unit Well 69, a gradual improvement has been observed. The average daily oil production for the first four months of operation was 42 barrels per day, compared to an average of 162 barrels per day for the last four months of 1950. This is a 286 percent increase in oil production.

To May 1, this year, 7,573,644 barrels of oil together with 1,211,238 barrels of water have been produced from the Wesson Hogg Sand Reservoir. Total water injected amounts to 9,094,682 barrels. The accumulated oil production to date represents a recovery of 251 barrels per acre foot or 25.1 percent of the estimated ultimate recovery of 30,185,000 barrels.

ACKNOWLEDGMENT

The author sincerely appreciates the assistance given by Vernor J. Turner, chief engineer; James Scurlock, geologist; and Miss Ruth Cravy, secretary. Appreciation is also extended to the management of McAlester Fuel Company for permission to publish this paper.

REFERENCE

[1] Lewis, James A., "Preliminary Report on Analysis of Expected Performance, Hogg Sand Reservoir, Wesson Field, Ouachita County, Arkansas," December 13, 1947, report not published.

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CORROSION AND SCALE CONTROL

By EDWARD N. JONES
Consulting Petroleum Engineer, Pettus, Texas

BESIDES THEIR USE in well completions to increase oil and gas production, acids have many applications during the producing life of a well. The versatility of acids as well as their correct application are described by the author in the removal of carbonate scale, cleaning well bores, and retrieving stuck liners. Case histories of wells successfully treated with a scale-removing compound are cited.

CALCIUM carbonate within a well bore or a producing formation is a major source of trouble in oil-producing operations, for it tends to plug pores through which the oil must travel to the well bore, as well as scaling tubing and liners, all of which results in reduced production and costly workovers.

Figure 1 is a front and rear view of a carbonate calcium plug or "button." It is unique inasmuch as it is the only plug actually known to have been recovered in one piece from a well. The button tells a story of conditions that could happen in any well and which are present in many wells. It shows how through the actions of salt water, gas, formation temperature, turbulent motion and reduction in pressures, the outer edges began to form. As the mixtures emerged from the shot holes in the casing the outer rim of carbonate started to build up. This continued until the scale had entirely covered the hole, cutting off production of any fluids or gas. The plug, as it gradually built up, started acting as a filter, thereby trapping behind it very fine particles of sand and shale. This tended to effect a better seal.

This button was recovered from a well producing from the Mackhank sand in the Wilcox series. This particular well produced oil with a small amount of brackish water. Production from the well gradually declined to a point which made operations unprofitable, and because offset wells also were good producers, the operators were of the opinion that some obstruction was gradually shutting off the production. In order to determine the reason for the decline in production, they pulled the tubing but did nothing to disturb conditions at the bottom of the hole. A hydrostatic bailer was used, and when it was tripped at the bottom of the hole, the whole button and parts of others were recovered. Besides the buttons, fine pieces of calcium carbonate scale were recovered. Several loads were obtained from the hole and it was thought that acid would clean and remove all scale, particles of sand and shale, thereby cleaning the perforations and face of the sand so the well would again be a good producer. Acid was dumped on the bottom of the hole, agitated, and removed. The well was returned to producing oil, and the amount was the same as at the time it started to fall off.

Although this obstruction was obtained from the Wilcox series, it does not mean that this is the only body of sand where calcium carbonate is formed. This obstruction is formed in many wells in various sands. In many cases, one well on a lease adjacent to a number of other wells has had its production shut off completely, while the forming of a calcium scale obstruction was not noticed in any of the offset wells.

Well acidizing has been extensively discussed in the literature and the subject of sand acidizing has been treated at some length.[1]

A prime requisite in the use of acids is to place the chemical opposite the desired formation to be treated whether by dump bailer or by running the tubing down the hole so acids can reach the desired point at strongest solution. This is very important. Laboratory tests and workover jobs have proven this conclusively. If the strong acid solution is poured into the casing at the top and has to pass through oil and a high water column before reaching the point of the perforation, the water will dilute the acids thereby cutting down their strength and mitigating their dissolving action.

Bailer Dump Method

The bailer dump method is merely the use of any bailer capable of holding acid until the bailer reaches bottom and when tripped leaving the acid on bottom. This method places the acids on bottom in their strongest solution. Another function performed by the bailer is that each trip to the bottom causes agitation or a turbulent motion of the acids, thereby reactivating them. The fact is well known that acids will work for a while on scale and many times stop working before all scales are dissolved because of a jelly-like material formed causing the inhibition of acids to scales. The acids, being agitated, remove the jelly material giving the raw acids further opportunity to attack the scales. The quantity of acids should be sufficient to dissolve completely the scales and clean the hole. The cost of acids in relation to the workover job is small and one should not reduce the quantity of acids so as to effect a slight saving in the over-all job. However, there is the definite danger of over treating with acids. Studies should be made of case histories before acids are used.

After sufficient acid has been put on bottom, the dump bailer should be run up and down in the perforations, screen, or open hole section to stir up

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thoroughly the acids and cause them to enter the perforations and create a washing action behind the liner. Marking the sand line at the surface will indicate to the operator when he is pulling sand and other materials into the hole. After a loss in footage on the line, a regular hydrostatic bailer or a common type plunger bailer will remove the accumulated material. It is good practice to remove this material frequently as it can become packed in the bottom of the hole shutting off a part of the producing formation or causing sand to be produced with the fluids at a later date, thereby cutting up the pumps or working parts of the equipment. In the event the operator has used too much acid and the solution is still strong on bottom and he wishes to remove the acid by pump, recommended procedure is a quantity of bicarbonate of soda, as used in drilling fluids, mixed with water and dumped on the bottom of the well. This tends to neutralize the remaining acids, causing them to become inactive. The neutralized acids can then be removed by regular steel pumps, but be certain that none of the equipment has chrome alloy steel or chrome-plated barrels.

Tubing Method

Safest method and the surest way to get acids to the bottom with little additional work is to use the tubing as the conduit string if the bottom of the tubing is at the bottom of the well. After the acids have been poured in the tubing, the operator should use water or oil to displace them in the tubing so all acids will be on bottom and will not remain in the tubing. The tubing is then removed from the well and the same method used to agitate the acids and remove foreign matter in the bottom of the hole as described under the dump bailer method. Another method that has been tried successfully is to place the bottom of the tubing below the producing stratum in the hole and after displacing acids from the tubing, run a regular swab in the tubing. After the swab is well in the fluid, it is run up and down, pulling the fluids up and then letting the swab down the hole, thus causing the acids to work back and forth past the perforations.

Cleaning of Liners or Screens

Many operators go to the expense of removing liners or screens from wells for the purpose of cleaning this equipment at the surface and reinstalling after the open hole has been underreamed or cleaned out. This is uneconomical and unnecessary as acids, if properly used, can clean liners already in the hole. In many cases, operators have used acids to remove foreign matter from clogged liners and, not satisfied with the results, pulled the liners to see if they were clean. In each case the liners were clean. If production had not materially increased, the operators reacidized the sand formation, removing the acids as soon as possible, especially in the case of low bottom-hole pressure wells.

Cleaning for Removal of Stuck Liners

On many occasions, operators have tried without success to remove liners by the use of line or tubing jars. They then resorted to cutting the liners in pieces and removing them piece by piece, and in many instances never have quite succeeded in removing the entire liner. A simple method of removing the liner is to place a quantity of acid, sufficient to more than cover the liner, and leave the acid in the liner for a period of time, or use the agitating method to remove the scale and foreign matter that acts like cement to grip the liner.

Scale adheres to metal holes or slots, closing the openings, causing fine sand particles and fine shales to be filtered, thereby gradually filling the annulus between the liner and well bore. This action cements a liner firmly in the hole. Liners are often recovered in one continuous piece and with a slight jarring action the packer is knocked loose after acid is properly used. Some liners remain in the hole because the packing sleeve, or the packoff, is stuck. This is often the opinion when a liner cannot be moved, but in many cases the liner is cemented due to the previously mentioned condition. Work and expensive jobs can be eliminated through the use of small amounts of acids.

Removal of Muds

Not infrequently, after a well has been producing for a number of years, a form of mud is noticed with the production, impelling the operator to undertake an expensive workover job based on the theory that the casing has sprung a leak, the casing seat has broken down, or the formation is no longer productive. These conditions should, of course, be considered but in many instances the conditions can be traced to improper cleaning of the hole at the time of completion.

One of the simplest and most inexpensive methods is to use acids at the time the well is being cleaned with water to remove the muds. No operator has been able to clean definitely the face of the formation or to clean the inside and outside of the tubing, and inside of casing without the use of some chemical as well as water. There are too many cases where the wells were washed clean with water yet later produced mud. After recleaning or circulating with water and acids these wells no longer produced mud. Normal muds build up a well on the formation and on the walls of pipe and this sheath remains in place for a long period of time. The proper time to remove the muds is during the cleaning period previous to completion. A suggested method is the circulating of clear water, then approximately 500 gallons of wash acid, and continuing circulation until acids have reached bottom and returned. The end of the tubing can be set opposite the formation and the acids circulated slowly by the perforations so all mud

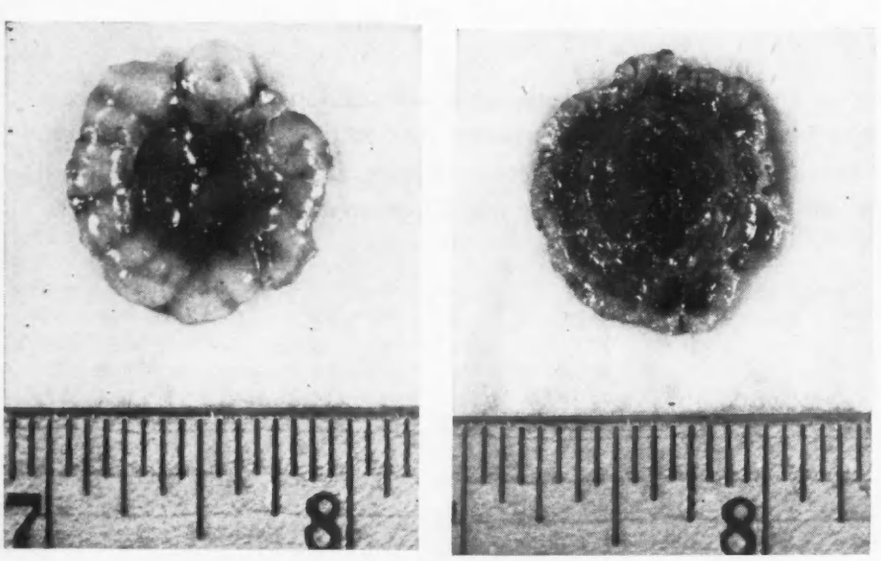

FIGURE 1. Front (left) and rear views of a calcium carbonate "plug" or button recovered from an oil well in Texas which was being cleaned out. It is believed to be the only such plug ever recovered intact from a well drilled in the U. S.

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can be removed, thereby cleaning the face of the formation at the same time. This may seem like an additional and unnecessary expense at the time, but it cleans the hole and formation of contaminating muds.

Chemical Treatment for Scales

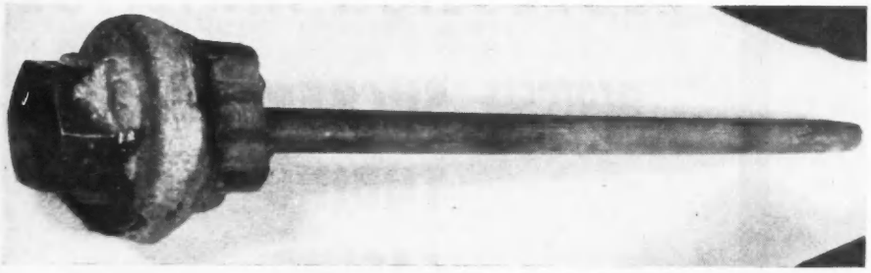
A non-acid scale remover has been used to soften carbonate scale and has shown to be effective as a corrosion control agent. Reaction of the chemical with formation produced waters causes these waters to become stabilized and the salts will not form the scales so prevalent in many wells. Removal of the scales already formed is definitely effected and the scales are dissolved. Several case histories were checked continuously from month to month to verify these conclusions.

One well producing from the Massive sands flowed approximately 536 barrels of water a day with some 75 to 80 barrels of oil. The distance from well head choke to separator was 176 feet. Temperature of fluids at the choke was 129° F., at the separator 129° F., and at the outlet of gun barrel 128° F. The dump valve at the separator was building up a thick deposit of calcium carbonate scale on an average of every three to four weeks. The valve and automatic bleeder lines were observed every two weeks to 30 days. The lines, separator and bleeder lines were acidized, but this did not remove all the scale, and it is the writer's opinion that not enough acid was used as the material was dissolvable in acid. However, in about three weeks the separator valve was sticking closed due to scales having been built up on the slides of the dump valve and the entire valve body itself was covered on the inside with a thick coating of scale. The four-inch bleeder lines had been reduced to approximately one-inch inside diameter, due to calcium scale deposits.

Treatment with the chemical was started. The well had a packer installed so the chemical could not be injected down the casing as generally prescribed. A force-feed pump was used and the outlet connected to the flow line immediately after the choke, which caused the fluids and chemical to become well mixed. This type of pump ran more consistently at a medium speed than at a slow speed, so one gallon of the chemical was mixed with three gallons of water and this mixture was injected over a period of 24 hours. After two weeks, the separator valve was inspected and it was observed that the scales were definitely being removed. One gallon per day was continued for another two weeks and after inspection at this time, all of the scales had definitely been removed. As an economy measure the treatment was cut to two quarts per day. After one month's operation, the valve was inspected and a small, thin deposit was found. The treatment was increased to three quarts per day and inspected a month later. All scales had been removed and their formation apparently had been arrested. This valve was inspected six months later and the condition was unchanged. The treatment of three quarts per day is the regular daily scheduled treatment, and it has now been going on about a year.

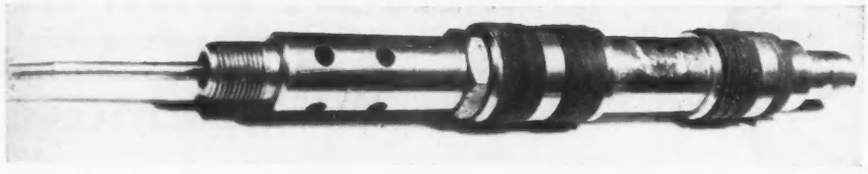
This chemical has been used in wire line controlled gas lift wells that could not operate more than three weeks without clogging all the lift valves so badly that the 1.25-inch bar could not be pulled through the upper valves and the line had to be parted. This was done many times and the tubing pulled each time so the valves could be cleaned and the well put back on production. A treatment of one gallon per day was injected into the line feeding gas to the well at intervals of one quart per six hours. The rod used to trip the valves was pulled every week for inspection. No scale was on the rod from the point where gas was injected up the entire length of wire. The operators were satisfied that the chemical was doing the work and sought to cut expenses. The treatment was reduced to two quarts per day mixed with 1½ gallons of water and a quantity of one-half gallon of the mixture put in the gas line every six hours. As last reported, the line and bar were removed after two weeks and the entire recovery of soft scale over rods and 7300 feet of wire line amounted to approximately a teaspoon of soft scale. This trial project has now been in progress several months with good results. The bar is no longer pulled weekly and it is inspected only once a month.

There are several cases where a well's production was increased after the operator noticed quantities of sand and muddy water being produced. The reaction of the chemical in removing those scales formed at the producing point of the bore hole has been given credit for this increase in production. There is reason to assume this as the chemical will fall through water and will go to the bottom of the hole. This actually occurs so it is highly possible that if scales are removed at the top of the hole, it is more probable the effects will be greater at the bottom of the hole due to increase in temperature.



Brass separator valve showing buildup of scale before a chemical inhibitor was used. After about 12 months trial with the inhibitor, this scale had not been completely eliminated.

This is a side door choke that had been stopped up by scale after being installed only 30 days. There was no scale deposit from the point where the chemical and gas entered the tubing.



Scale-free side door choke with conduit tube from the orifice extending down below the choke so that the inhibitor and gas could be injected into the fluid stream below the choke. Scale was eliminated entirely. This choke has been in service for 28 days, although more fluid was produced through it than through the choke shown scaled up.

REFERENCE

[1] Jones, Edward N., "Acidizing Techniques in Sand Formations," WORLD OIL, April and May, 1949 (Two Parts).

Supply, Sources and Treatment Of Flood Water

By H. S. BARGER
Consulting Petroleum Engineer, Evansville, Ind.

PROBLEMS WHICH the operator faces when considering a water-flood program are discussed in a manner which will enable him to evaluate his own properties in deciding which approach to make. The increased recovery of oil from applicable water floods has brought about additional attention to the details of this operation, and the author describes many of the new factors about which considerable information is known. This paper points the way toward a balanced flood program from both the economic and operating point of views, and suggests several possible avenues for future research.

PROCUREMENT of an adequate and suitable water supply is an important phase in the development of all water-flood projects. The cost of obtaining and treating the desired water is a major factor in the economic life of a water-flood project. Current developments of large water-flood projects are revealing the magnitude of water supply problems.

The treatment of flood water is a special phase of general water treatment. Early water-flood operators paid too little attention to the proper treatment of flood water, but in recent years, operators have recognized the necessity of proper water treatment. At the same time, the water treatment industry was not cognizant of the problems in this special phase of water treatment, but they, too, are becoming much more interested. In general the treatment of flood water is receiving much more attention from both the oil operators and the water treatment industry than at any previous period.

Water Supply Volume Requirements

The volume of water supply required on any project will depend on whether the produced water is recycled or disposed of through other means. In general, the best practice is to make provisions to recycle produced water, thereby reducing the supply volume requirement.

When produced water is to be recycled, the volume of water supply required should approximate the volume of fluids (oil, gas and water) produced to date, plus the amount of water flood oil that is expected to be produced. To this amount must also be added the amount of water that will be lost to thief zones, to outside extremities of the reservoir, to surface and subsurface leakage, and evaporation. The total volume of water supply on an average, when the produced water is recycled, will approximate 1½ to 2 times the amount of oil that will be produced by both natural and water flood production.

When the produced water is not recycled, the total volume of water supply will approximate 12 to 15 times the estimated flood oil recovery.

Reservoir conditions that may increase the water supply volume requirements are:

- Unplugged holes that may permit the injected water to migrate into upper or lower formations.
- Oil-producing zone connected updip to gas producing area.
- Undeveloped extensions to reservoir.

Newer fields require less water supply volume than older fields.

With the proper evaluation of the natural production history, the existent reservoir conditions and predicted water-flood recovery, a reasonable estimate can be made on the water supply volume required.

The daily requirements of water supply can be controlled by the rate of water-flood development as well as by the daily injection rate into individual wells, but the daily requirements must fit into the over-all economics of the project. The daily injection rates in use today vary from 0.3 to 1.5 barrels per acre-foot per day. A daily injection rate of 0.5 barrel per acre-foot per day will satisfy an economic depletion-time for most reservoirs. Similar data for limestone flooding are not available, but generally, the daily injection rate is two to three times the average rate for sand injection.

Chemical Composition Requirements

The supply water must be chemically compatible to the connate water in the formation or easily made compatible by further chemical treatment. Complete chemical analysis should be available of the supply water and of the connate or formation water. The effects of chemical reaction between the constituents of the waters that may be mixed either in the injection system or in the formation, should be considered carefully. Samples of the waters should be mixed and a visual observation made of their reaction along with the complete chemical analysis of the mixture.

Waters containing barium or strontium are incompatible with waters containing sulfates. The rate of precipitation of barium sulfate is so slow it is almost impossible to remove the precipitate within the treating system. If water containing barium or strontium is to be injected into a formation that contains sulfates or vice versa, the produced water should not be reinjected but should be disposed of otherwise.

It is also desirable that the supply water be compatible to any clays or shales that may be intermingled with the sand.

Corrosion constituents should be a minimum or of such a nature that they can be economically removed or rendered ineffective.

The water supply must be relatively consistent in chemical composition in order not to disrupt chemical treatment.

Water Supply Availability Requirements

An adequate and continuous supply is a must in water-flooding. The daily requirements are usually less than maximum at the beginning of opera-

tion and gradually build up to maximum. The maximum daily requirement of water supply is needed for a period of one to two years or until produced water reduces the requirements. With the recycling of produced water, the supply requirements gradually decrease until at or near the end of flood life the daily supply requirements are 10 to 20 percent of the daily injection requirements.

Fresh water was used almost entirely on early flood operations, but at present flood water is about equally divided between fresh water and salt water. The most common sources of fresh water and their advantages or disadvantages are as follows:

- Gravel bed waters are usually easily treated and usually very consistent in chemical composition. To have sufficient capacity they must be located near a sizable stream. Sizable stream location from area of operations may cause high procurement costs. If source is from local gravel beds, withdrawal of sizable quantities may dry up domestic supply.
- Rivers and streams provide water of changing composition, making steady flow of treatment difficult. Their capacity may be adequate or limited, depending on the size of stream, etc.
- Lake waters are easily treated and have good consistency of chemical composition. Capacity is usually very limited.

In a few instances, water-flood operations are situated where it is possible to purchase water from a municipal supply. In other instances, cooperative or joint water supply sources are developed to serve several projects.

Salt water is obtainable from the following sources and their advantages and disadvantages are as follows:

- Subsurface salt water-bearing formations or aquifers provide salt water that usually has good consistency of composition. Capacity ranges from small to ample, but usually expensive equipment with high operating cost is needed to obtain the salt water. It may have constituents incompatible to formation water.
- Produced salt water from other oil-producing formations usually requires treatment, and supply capacity is usually inadequate. It can be used as supplement water in many cases, but rarely is produced water available in sufficient quantities for total supply requirements.

About the Author

H. S. BARGER was graduated in Petroleum Engineering from the Missouri School of Mines in 1939. In 1940, after approximately one year in various types of oil field work, he was employed by Adams Oil and Gas Company as a petroleum engineer for operations in the Illinois Basin area. In 1944 he joined Felmont Corporation and was in charge of the engineering of one of the early water floods in Illinois. In 1945 he became chief engineer for Felmont Corporation and was engaged in water flood operations in the Illinois Basin and the Mid-Continent areas. In 1947 he joined Sohio Petroleum Company as head water flood engineer and was in charge of the engineering of all of Sohio's water flood operations. He later became assistant superintendent of Sohio Water Flood Division and held this position until he resigned in 1950 to set up his own consulting firm in Evansville, Ind.

Flood-Water Treatment

The prime objectives of flood water treatment are:

- To condition the water so that it will not deposit any plugging material in the well bore or in the formation, thereby reducing the intake capacity.
- To condition the water so that it will be compatible to the clays or shales within the oil-bearing formations.
- To prevent or minimize corrosion.
- To increase the efficiency of the water in removing the oil from the formations.

The constituents that often cause plugging are: Suspended matter, iron compounds, excess calcium and magnesium carbonates, barium sulfate, manganese compounds, and algae and bacteria.

Laboratory and field performance indicates that clays and shales present within the formation may hydrate in the presence of certain water, thereby reducing the injection capacity. Laboratory tests on some sands indicate that the pH of the water should be as low as is practical to use. Field performance tends to bear this out, although sufficient data is not available at present.

The principal constituents that cause corrosion are: Dissolved oxygen and hydrogen sulfide. In the past, carbon dioxide has been considered one of the corrosive constituents but field performance of closed systems indicates that carbon dioxide in itself does not materially add to corrosion.

Water Treatment Systems

The two common types of water treatment systems in use today are called open and closed systems.

The open system is similar in principle and operation to most municipal water treating systems. The open system is based on the theory of removing all the undesirable constituents that would cause plugging. At the same time, the water is stabilized to some component. Open system treatment usually includes aeration, chemical treatment and flocculation, sedimentation, and filtration. In many open systems, after filtration, the water is treated with complex phosphates to prevent further precipitation. In other systems, after filtration, the water is de-oxidized by vacuum or chemical treatment to minimize corrosion. Uusually a bactericide or algaecide is added for control of micro-organisms.

The closed system is based on the theory that water produced from an underground source or formation is in a state of equilibrium and that it can be transferred through a closed system to another formation without any plugging effect on the second formation. In a typical closed system, the water is pumped through a closed pipe line system directly to the injection wells. Air is excluded from the system and little or no chemical treatment is given. In systems where the produced water is recycled, usually a stabilizing compound is added to prevent precipitation.

Both type systems have been and are currently being used successfully in water-flooding.

The open system, which is conventional, is capable of treating any kind of water. It is more adaptable to large

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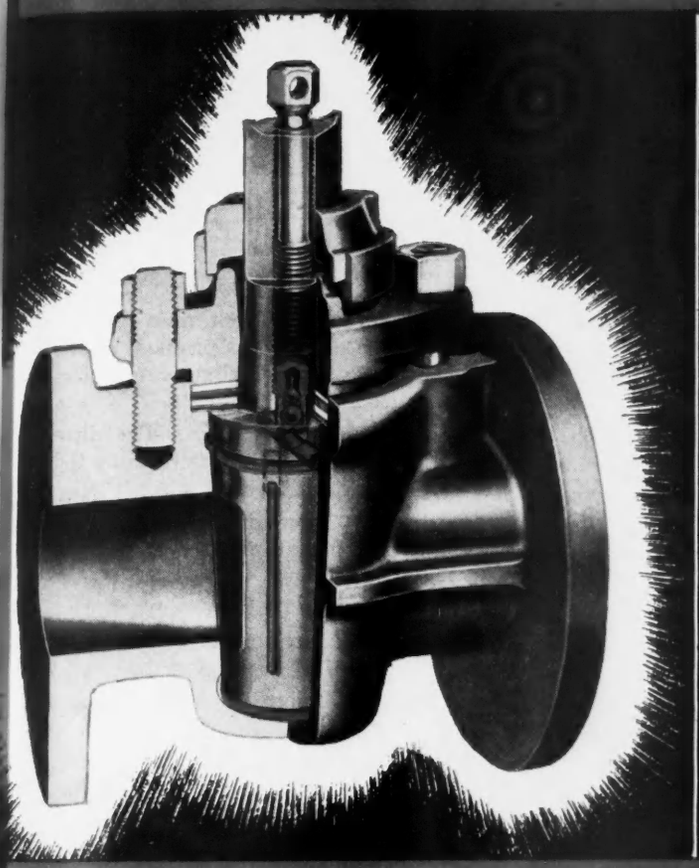

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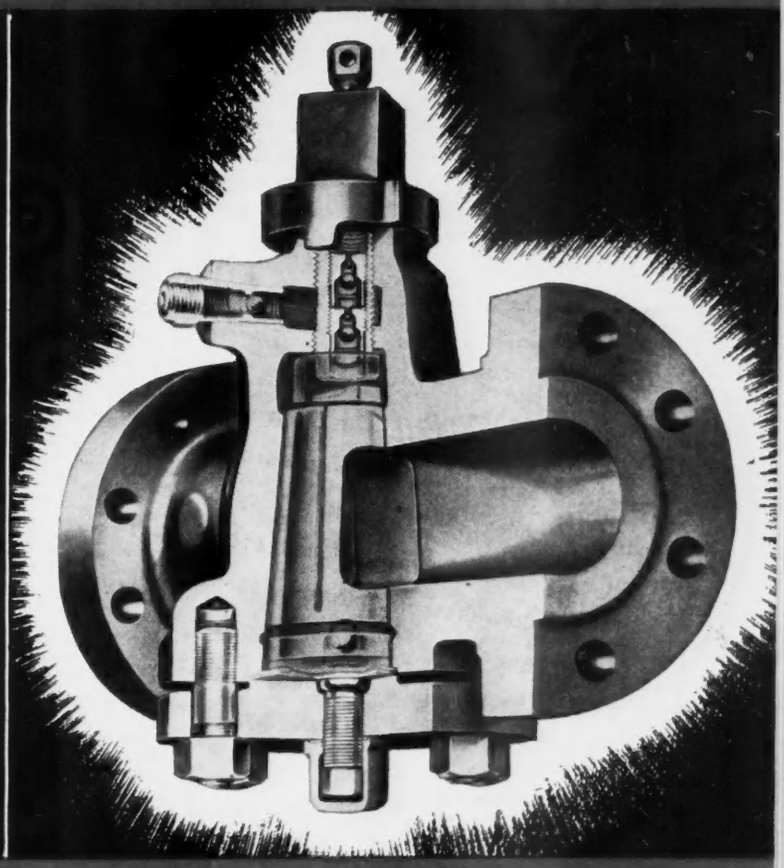

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quantities, and provides better control of chemical constituents. On the other hand, it is more expensive, both in initial investment and in operating costs, and often releases gases that are desirable for injection.

The close system of flood-water treatment has a lower initial cost, since there is less equipment required. Operating costs are lower, and corrosive problems are fewer. It is also highly adaptable for small installations. However, in the closed system, it is difficult to keep oxygen free, and it is also difficult to return produced water to the injection system. This system provides less control of chemical constituents and is limited to compatible waters for satisfactory results.

Flood Water Costs

Treating costs of flood water is relatively minor in most cases. The chemical cost ranges from less than one mill to three mills per barrel.

The over-all cost of flood water, which includes producing, treating, pressuring, and distributing, ranges from 1½ to 2½ cents per barrel. The producing cost is generally the largest factor in the over-all cost. Since the average water-injected produced-oil ratio is approximately 15 to 1, the over-all cost of flood water is a very important factor in the economic life of a water flood project.

Future Study and Research

There are many common and special problems related to flood water and flood water treatment that merits future study and research. Some of the important problems for future study:

- Determination of optimum chemical constituents and physical characteristics of injection waters for various formations;
- Flood water efficiency. The improvement of flushing efficiency by the use of additives;
- Effect of non-compatible waters within a formation:
- Corrosion causes and preventative measures.
- Controlled aerations in water treatment.
- Control of micro-organisms in water treatment.
- Improvement of design in water treating equipment, particularly for salt water.

These and many other water flood problems offer a fertile field for future study. Major improvements in many of these problems will greatly effect the economics of future water flooding.

BIBLIOGRAPHY

[1] Breston, J. N., "Conditioning Water for Secondary Recovery of Oil in the Appalachian Fields." *Producers Monthly*, Vol. 14, No. 7, pp. 16-26, May, 1950.

[2] Watkins, J. Wade, Arthur, C. E., and Willet, F. R., "Conditioning Water for Sub-surface Injection." *The Oil and Gas Journal*, August 17, 1950, pp. 120-128.

[3] Cecil, Lawrence K., "Injection Water Treating Problems." *World Oil*, August, 1950, pp. 176-180.

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Intermitter Installation Conserves Low-Pressure Fuel Gas

IN a shallow North Louisiana operation gas lift equipment was installed at the bottom of a 1650-foot well which had low bottom-hole pressure. The installation was of the chamber type, with two-inch tubing set on a packer above the four-inch by 100-foot chamber below the packer. Gas was injected in the casing for 10 to 15 seconds every 7½ minutes to lift to the surface whatever fluid had collected in the chamber. The gas and fluid—the latter being 80 percent water—flowed to a separator, whence oil and water went to the tank battery while the spent gas was flared.

It was later desired to put the lift gas into a fuel gas system which operated at 25 pounds per square inch. However, upon placing 25 psi back pressure on the well it was found that production was decreased from approximately 100 barrels of fluid per day to 35 barrels per day (due to the low bottom-hole pressure).

The problem that existed, therefore, was how to deliver gas to the 25 psi fuel system and yet keep no back pressure on the well. It was solved by coming off the tubing with a vent line in which was installed a diaphragm operated valve. To control this valve a second weight bar and bleed valve were added to the gas intermitter control, and a tooth shaped flange added to the control clock (for the weight bar to ride on). Therefore, there was one weight bar that operated the gas intermitter and a second that operated the vent line valve.

The intermitter control with the extra weight bar which actuates control to open vent line valve and allow gas in tubing to vent to atmosphere. Back-flow from the separator and fuel system is prevented by check valve in flow line at wellhead.

The operation proceeded as follows: as the clock turned, the first weight bar was raised for 10 to 15 seconds, applying gas pressure to the intermitter valve and thereby injecting gas into the casing for a like period of time. Thirty or 40 seconds later the second weight bar was lifted, releasing pressure from the vent valve diaphragm and allowing the vent valve to close. A few second after the vent valve closed gas and fluid from the chamber hit the surface, going through the flow line to the separator. Gas from the separator was directed to the fuel system.

The vent line valve stayed closed for two minutes, which allowed sufficient time for the gas and all of the fluid to enter the separator. The second weight bar then dropped off of the flange "tooth," applying pressure to the valve diaphragm, thereby opening the vent line valve and allowing all gas in the tubing to vent to atmosphere. Gas from the separator and fuel system was prevented from back flowing by a check valve in the flow line at the well head.

The tubing was open to the atmosphere for 5½ minutes; then the cycle was repeated.

Thus, the fluid and 80 percent or more of the lift gas was flowed to the separator—the gas being saved and put in the fuel system. The remaining 20 percent (or less) of the gas was vented and no back pressure was held on the formation for 5½ minutes of the 7½-minute cycle. Eighty percent of the gas was saved at no sacrifice of fluid production.

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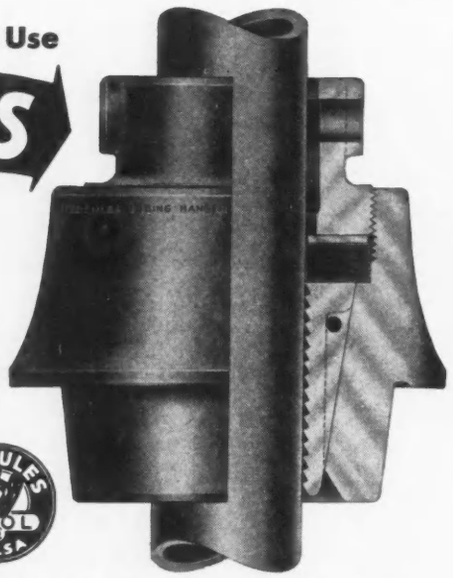

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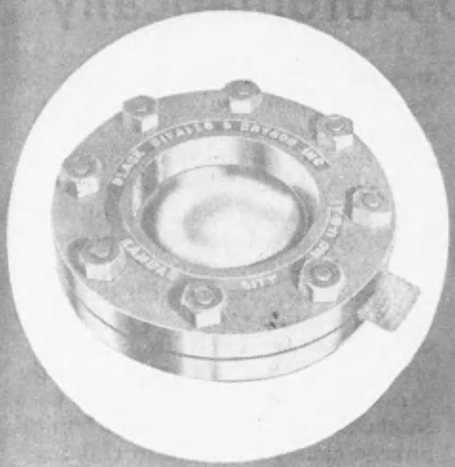

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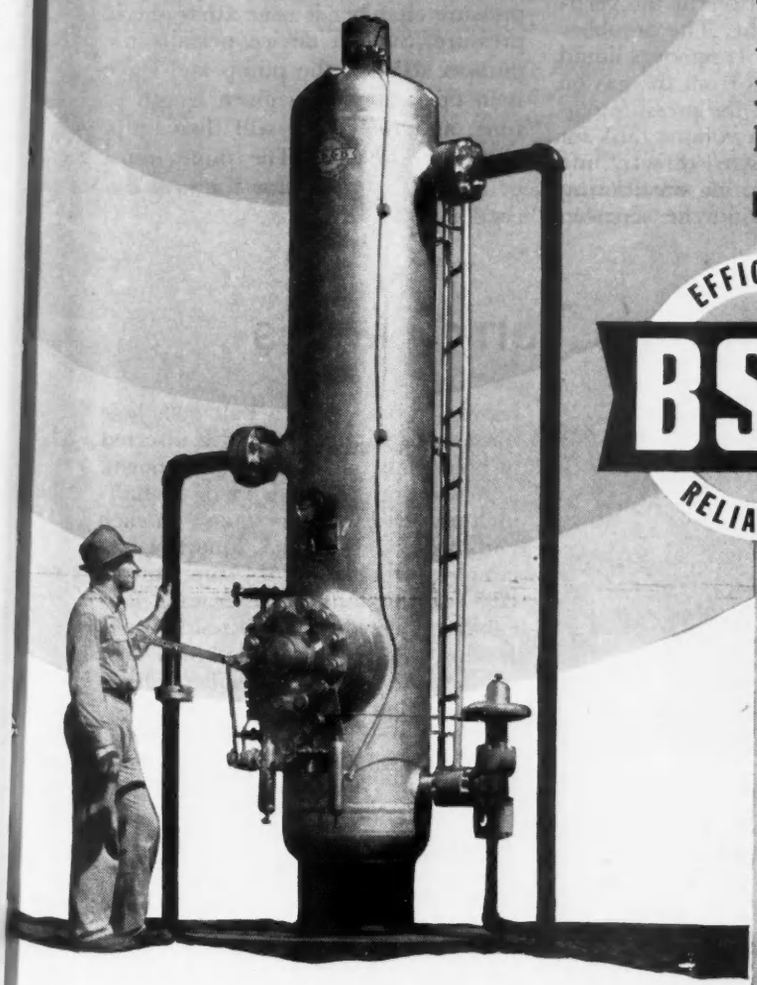

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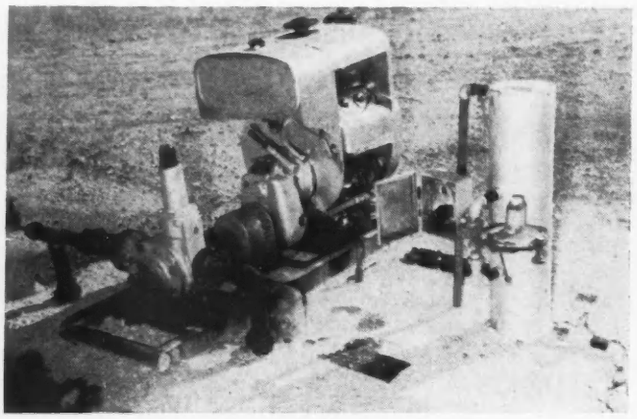
HOW TO—Shut Off Oil Transfer Pump Automatically

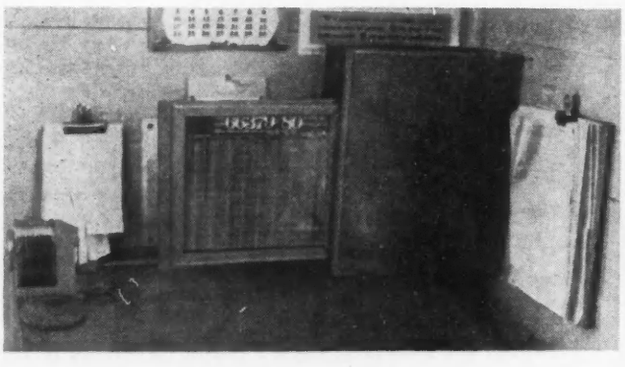


When transferring oil from one tank to another, when rolling a tank to mix its contents, or when removing the oil into a gathering system, it is unnecessary to have the pumper remain at the pump during the operation. A time clock will do the job of shutting off the pump at the end of a given period, determined by the lease pumper.

Illustrated is a small capacity, centrifugal pump driven by a natural gas engine. Fuel is supplied from the lease gas system, and is properly scrubbed and reduced in pressure before entering the carburetor of the engine. The gas supply line is shown connected to the bottom of the vertical scrubber at right. The scrubber serves two purposes. It removes liquid and foreign particles from the gas on the upstream side of the pressure regulator, and acts as a volume tank for the low-pressure gas fed directly into the engine. A separating partition at the middle of the shop-made scrubber does the job. The pressure-reducing regulator is mounted on 1½- inch pipe that connects the two chambers. Gas from the low-pressure side discharges through a 1½-inch line to the engine.

The regulator can be shut off completely if desired, and it is the hand-wound clock that serves this purpose. A mechanical linkage with the clock and the regulator valve seat permits the gas to flow freely from one side of the scrubber to the other until the period preset by the pumper has been reached. At this time, the mechanical linkage causes the valve to close, and the engine shuts down shortly after that time when the gas in the low-pressure chamber is near atmospheric pressure. Such a device permits the pumper to start the pump and leave it in operation for a given length of time, and the pump will then automatically shut off. The pump must be started manually for the next operation.

HOW TO—Prolong Life of Pumper's Tank Tables



One of the lease pumper's most frequently used tools is a set of tank tables from which he converts the feet and inches of oil in a tank into barrels and fractions thereof. And, because of constant use, these tank tables suffer from wear and become "dog-eared" unless some method of preserving them is followed.

Illustrated is one method devised to prolong the life of the valuable tank strapping tables. There is a tank table for each tank on every lease in the field. Each table has a solid wooden frame and stiff paper backing. The frame can be made of 1 x 1-inch material with rounded edges.

The fronts of the tables are covered with a thick sheet of celluloid or plastic. (Glass can be used, but it is not the most desirable.) The lower right hand corner of each wooden frame is bored with a half-inch hole through which a metal rod is inserted to hold each table in place as shown.

A wooden cabinet is made of half-inch plywood which is square on each end, the sides of the square being equal to the length of the bottom edge of the tank table frame. The cabinet is enclosed on four sides only, leaving the front and top open. The cabinet can be made wide enough for several frames, as needed.

The metal rod extends through both ends of the cabinet to hold the tank table frames in place, and to serve as a hinge point for removing the frames when reference need be made to them. When lifted back in place, the frames rest evenly in the cabinet to make a neat unit that can easily be placed on the pumper's desk for ready reference. One of the tank tables is shown folded out for use.

It doesn't have to be this way...

YOU GUYS ARE REALLY RACKING UP THE RODS THESE DAYS. WHERE THEY ALL GOING TO?
SNAP!
CRACKLE!
POP!
YEAH, SINCE ALLOWABLES WERE RAISED RODS ARE BUSTIN' FASTER THAN WE CAN PUT 'EM IN THE WELLS
WE USE 'EM FOR FENCES MOSTLY, AFTER THEY'VE BEEN IN THE GROUND A FEW DAYS.

It can be like this !

SURE. THESE KOBE FREE PUMPS ARE MAKING THE NEW ALLOWABLES EASY. I'M SURFACING THIS ONE TO CLEAN THE INTAKE SCREEN. STICK AROUND IF YOU WANT TO SEE ALL THE CRUD WE KEEP OUT OF THE PUMP

...Free Pumping Makes the Difference!

It's a matter of simple arithmetic to figure how far ahead you are with Kobe Free Pumping.

Take down-time, for example: You can surface, inspect, and re-run the Kobe pump unit in less than 3 hours from a 5,000 foot well. One man does the complete job including changing the pump, if necessary. Compare this with replacing broken sucker rods and getting back into operation. And it takes a whole gang to do the work.

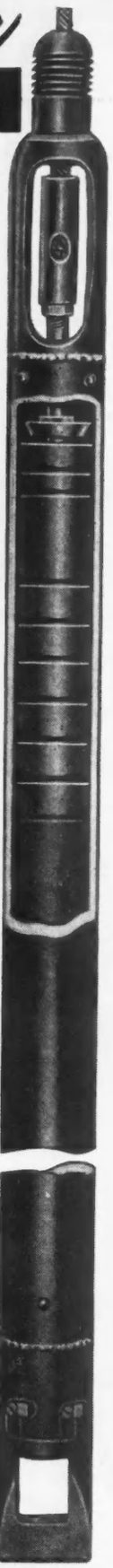
Then look at maintenance and repairs: No more sucker rods to buy—ever. No counter-balances to be shifted every time water or gas conditions change. No moving parts at all except the Free Pump, itself, and the rugged, trouble-free Kobe Triplex which operates the hydraulic power supply.

Yes, Kobe is the modern answer to economical oil recovery—savings in operation costs of 25% to 40%—savings in equipment up to $5,000 per well. Get the facts and you'll get Kobe. Call your nearest Kobe representative TODAY!

Free Pump
KOBE
ONE OF THE DRESSER INDUSTRIES

KOBE INC. Division of Dresser Equipment Co. *General Offices:* Huntington Park, California. *Division* and *District Offices:* Avenal, Bakersfield, Huntington Park and Ventura, California; Great Bend, Kansas; Hobbs, New Mexico; Healdton, Oklahoma City, Tulsa, Oklahoma; Brownfield, Corpus Christi, Fort Worth, Houston, Kilgore, Odessa, Texas; Casper, Wyoming; New York City.

Miller SAND PUMPS



In every major producing area where sand or sediment is a problem, you'll find Miller Sand Pumps and Bailers are standard . . . the leaders in clean-out equipment. For 26 years Miller has held this leadership, with continuous improvements and faithful service.

The Miller Sand Pump is made in regular and heavy duty types in sizes listed below. Lug type, chisel, sand and bailer bottoms are easily interchanged.

SAND PUMP and BAILER SIZES:

Outside Diameters

2½"
3"
3½"
4¼"
5"
5½"
7"

Lengths

20 feet
25 feet
30 feet

Special Sizes and Lengths Made to Order!

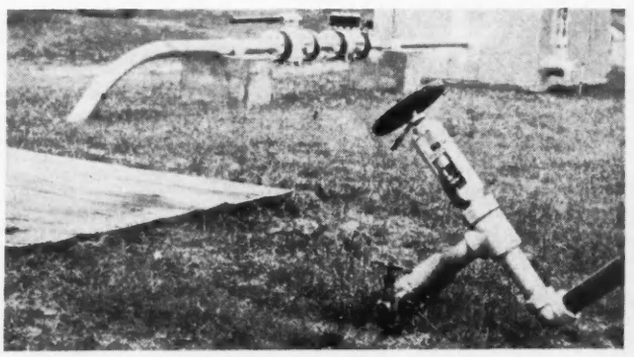
Write for new descriptive price list on Miller Sand Pumps and Bailers. See Composite Catalogue Page 3305 for details.

MILLER SAND PUMP CO.
1524 S. E. 29 St. . . . . Box 4516
OKLAHOMA CITY 9, OKLAHOMA

EXPORT OFFICE:
30 Rockefeller Plaza-New York 20, N.Y.

PRODUCTION HINTS

HOW TO—Bleed Gas Injection Line



The problem of hydrates forming or liquid condensing out in a gas injection line is as real as on a gas producing line if the injection gas has not been previously stripped completely of its moisture content. The installation shown here is one practical device for bleeding liquids from high pressure gas injection lines to unload a slug that accumulates in a low section of the injection line.

It was not practical in this case to install moisture extraction equipment on the injection lines, and the minor trouble developed principally during the winter could be handled effectively by this bleeding device.

Low points in the injection line were created to trap liquid formations in the line. At these points, a tee was welded in the line and a branch tap extended to the surface where an adjustable choke was installed. An ell and a short nipple were added to the discharge end of the choke to direct the exhaust into the air.

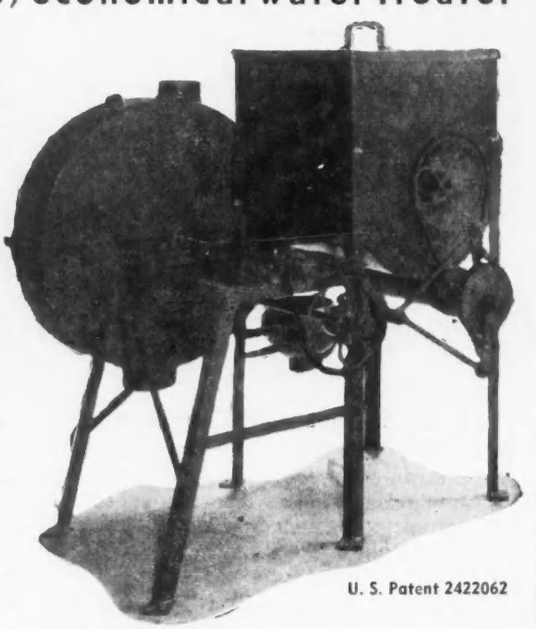
Purpose of the adjustable choke was to provide the pumper with a means of controlling the flow through the branch line which carried the same pressure as that of the main injection

THE
WESTERN CHEMICAL FEEDER
the dependable, economical water treater

CHECK THESE FEATURES:

- Used in Oil Well Water Flooding, Municipal Water Treating Plants, Canneries, etc.
- Can be driven by water entering plant for treatment.
- Maintains pre-set water-chemical ratio through a wide rate-of-flow range.
- Adjustable two ways, to feed from a few pounds to several hundred pounds of chemicals per day.
- Also can be equipped with electric motor, or gas engine drive.
- Made to your specifications in various sizes.
- In use the world over.

Whatever your water treating problems may be, investigate the Western Feeder. Write for literature and prices.



U. S. Patent 2422062

Manufactured By

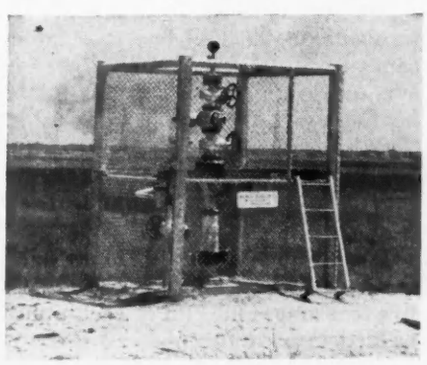
KEYSTONE SUPPLY CO.
312 E. Cherokee St. NOWATA, OKLA. Phone LD-10

line. In the event the line became clogged due to hydrate formation or a slug of liquids accumulated there, the pumper could merely crack the choke open and let these liquids bleed into the atmosphere until dry gas came out. Experience has shown that this practice has freed clogged lines in every case. Such an installation was provided near each injection well in a field where pressure maintenance was in progress.

HOW TO—
Construct Adequate Wellhead Enclosure

A precaution an operator must take to maintain genial relations with the landowner and protect the producing company is to keep roaming stock from brushing against the christmas tree of a high-pressure producing well. Such an enclosure also tends to keep outsiders from tampering with the valves and gauges on the wellhead equipment.

Illustrated is a relatively inexpensive enclosure used by one South



Texas operator. The wellhead enclosure is much smaller than normally found around a producing well, but it has been found adequate. The galvanized wire fence is supported by a heavy-duty pipe frame made of discarded pipe. The fence, which is about eight feet high, rests upon the ground around the well. It can be removed by lifting the entire unit with a winch truck in the event the well needs to be serviced or worked over.

To provide the pumper access to the well in checking the flow gauges and changing chokes, etc., a small opening was made in the wire fence by framing off a 2 x 4-foot opening in the upper part of the enclosure. A small pipe step ladder with hooks on the upper leg members holds the ladder in place so that the pumper may climb through the fence opening.

Eliminate

COSTLY STRIPPING JOBS

MADE NECESSARY BECAUSE OF PARAFFIN ACCUMULATIONS

CRALL Spiral Paraffin Scrapers are the Answer

CRALL Spiral Paraffin Scrapers have been installed in wells that required paraffin removal every ten days. After many months of continuous operation, after scrapers were installed, the wells still maintained normal production. This is a record that can't be ignored.

Check these features and prove for yourself that CRALL Spiral Scrapers cost you nothing in the long run. Many times they have paid for themselves in less than two months.

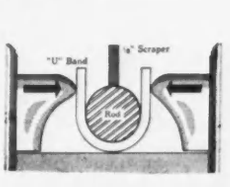
PASS SCRAPERS EVERY STROKE UP AND DOWN

1 Scrapers alternate — one right, one left — eliminating tendency of the rod to unscrew.

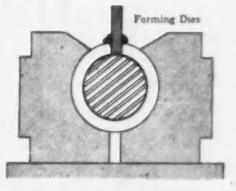
2 Scrapers are attached at our own plants under our personal supervision, and stocked at supply stores.

3 No maintenance costs. Practical, economical and adaptable to ANY pumping well.

4 Made of thick, mild steel. Sizes to fit 2" and 2½" tubing regardless of size sucker rod.



Cross section showing "U" band being die-formed around rod to the scraper blade.



Cross section showing band held under pressure around rod while ends of band are shrink-grip attached to scraper blade.

The original installation is the only cost. Order your CRALL Spiral Scrapered rods from your supply store or wire, write or phone . . .

PETROLEUM SPECIALTY CO.

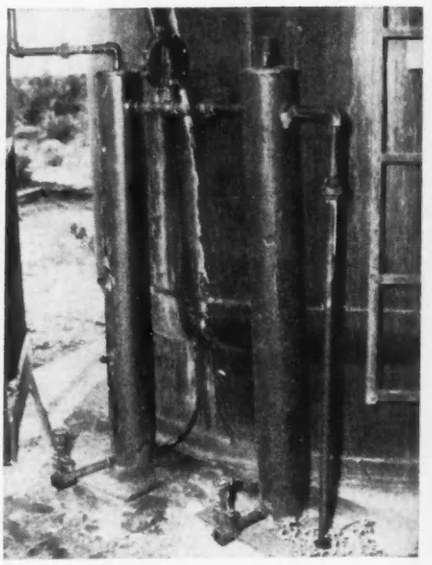
P. O. BOX 1640 PAMPA, TEXAS

Manufacturing, Fabricating Plants and Sales Offices

Pampa, Sundown and Odessa, Texas — Casper, Wyoming — Oklahoma City and Chickasha, Okla.

HOW TO—Insure Clean Fuel Gas for Heater-Treater

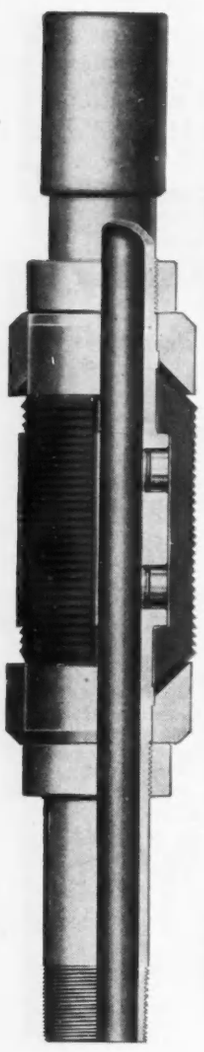
Where heater-treaters are on remote leases that are visited only once a day by the pumper, and where it is essential that these heaters function properly to obtain pipe line oil in the lease tanks, one of the necessary precautions in setting up the unit is that it be supplied with a good supply of clean fuel gas. Should the gas contain moisture or small particles of rust or sand, the burners might become clogged or heating element flame might be snuffed out, thereby interrupting the efficient operation of the heater-treater.



On one such lease, a double gas scrubber on the fuel line to a large-capacity heater-treater insures an adequate supply of clean gas to the heating unit. The scrubbers are in the fuel line above and below the gas regulator which drops the gas pressure to low pressure required by the heater.

The scrubbers shown are made of ten-inch line pipe measuring about five feet long. One end of each unit is welded to a square plate of quarter-inch steel about 20 inches on each side. This plate forms the base of the scrubber. The upper end is closed with a cap which has a one-inch nipple welded to it as shown.

The higher-pressure gas enters the first scrubber at right through the top line. Due to the relatively large volume, the velocity of the gas is lowered and any rust or scale entrained in the gas drops out, while the clean gas discharges out the one-inch line leading to the regulator between the units. After pressure is lowered to operating values, the gas enters the second scrubber at left near the top, and is discharged through the one-inch line connected to the nipple on the cap plate. Both scrubbers have clean-out lines welded to the bottom of each unit. These lines terminate in a gate valve that permits the pumper to clean each scrubber out periodically.


Type "B" Tubing Anchor

STOP TUBING TRAVEL with the PAGE Tubing Anchor

THE PAGE TYPE "B" Tubing Anchor gives you *six* advantages never before realized in conventional type anchors... they're possible because the Page Type "B" incorporates an entirely different operating principle—*it sets hydrostatically and holds hydraulically!*

The Page Type "B" Tubing Anchor permits . . . *(1)—assembly in the tubing string either end up (2)—fast run-in without danger of "accidentally" setting slips (3)—automatic setting without tubing manipulation (4)—setting at correct depths because slips set as fluid rises in tubing (5)—compensation for temperature changes (6)—easy release by simply draining tubing.*

The Type "B" Eliminates...

REVERSE TORQUE on tubing threads—main cause for high pressure leaks.

EXCESSIVE WEAR on casing, tubing and rods—common with compression anchors.

SUCKER ROD BREAKAGE caused by excessive tubing travel. The Page Type "B" Tubing Anchor keeps rod breakage at a minimum because it *smooths out* reversals in the pumping cycle.

Field records prove...

. . . that anchoring the Page Way *increases* pump efficiency and *decreases* equipment wear —visit your nearest D+B Pump Store or Continental Supply Store — find out how Page "Tension Type" Tools can help *you!*

PAGE TENSION TOOLS

PAGE OIL TOOLS, Inc.
3356 Lime Ave., Long Beach 7, Calif.

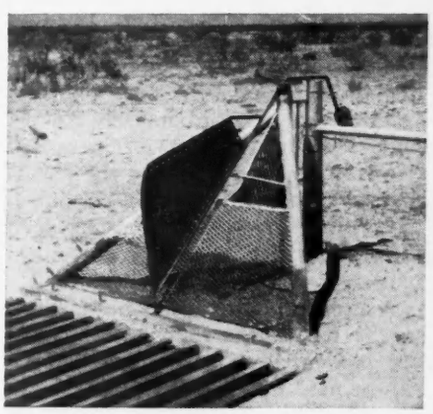
Mid-Continent Distributors
D+B Division—Emsco Derrick & Equipment Co., Garland, Texas
The Continental Supply Company Dallas, Texas

HOW TO—

Modify Cattle Guard For More Efficiency

Experience in West Texas has been that a hungry white face cow is difficult to keep out of a green pasture, and the ordinary cattle guard must bemodified to provide 100 percent protection in keeping the cattle where the rancher wants them. In one case, it was necessary to modify existing cattle guards leading into one important and active field to keep cattle from entering by means of the narrow end members.

A counterbalanced flange was added to the A-frame members at each end of the existing cattle guard. This flange device is similar to the rudder of a sail boat in that it is pivoted at the extreme ends, with the counterbalancing arm corresponding



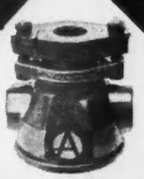
to the tiller. Salvaged sucker rod material forming the framework is shaped in a triangle. The lower end of the rod frame extends into a hole cut in the cross piece of the cattle guard, while the upper end extends through a hole cut in the vertical support for the A-frame. The rod is extended through the upper hole and bent in a horizontal position with the counterweight attached to a short angular arm pointing downward. Old tank plates were cut to fit inside the rod frame and tack-welded to it as shown.

Cattle are effectively prevented from entering the lease by walking over the ends of the cattle guard. The pivoting system was added so that when a truck with a load hanging over the truck bed passes over the cattle guard, the load strikes the rudder-like device, which gives way. Once the truck has passed, the flange returns to its normal vertical position.

MAKE THE RIGHT MOVE

INSIST ON ALTEN SURFACE EQUIPMENT

LUBRICATED STUFFING BOX



STUBBY TUBING HEAD

CLOVERLEAF STUFFING BOX

Alten equipment gives you deluxe features at rock bottom prices.

STOP COCK

WONBOLT POLISHED ROD CLAMP

It costs Alten far more to build equipment so that it costs you far less to operate and maintain it.

THE WORLD'S BEST PUMPING UNIT

Longest Strokes
Highest Gear Reducer Ratings
plus
Hardest Gear Surfaces

ALTEN

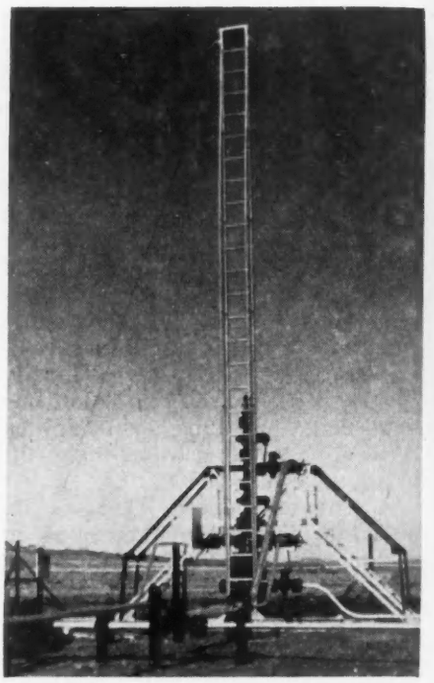
Pumping Units, Tubing Heads, Stuffing Boxes — every piece of equipment in the broad Alten line is fully performance proved. Get more for your money from the smallest Polished Rod Clamp to the largest Pumping Unit by asking your dealer to furnish Alten equipment.

ASK FOR COMPLETE ALTEN LINE
AT YOUR LOCAL SUPPLY STORE

ALTENS FOUNDRY & MACHINE WORKS, INC.
LANCASTER, OHIO

HOW TO—Construct Permanent Mast

Where frequent well measurements must be made on wells to determine the performance during the producing life of the well, it is a time-consuming job to set up the pressure lubricator used in running such well instruments. In order to simplify these operations, one Rocky Mountain company installed a permanent mast that facilitates the installation



of a lubricator for running such instruments as tubing calipers, bottom-hole pressure bombs, and other wire line tools.

The mast is approximately 32 feet high, although this measurement will depend upon the height of the christmas tree and the length of the lubricator required. It is made of salvaged 2⅞-inch drill pipe reinforced with a truss-type brace on each leg.

A square platform has been added to the top of the mast to which an eye is welded so that a small block can be used in hoisting the lubricator. The platform is 18 inches square and is made of two-inch pipe on which was welded quarter-inch plate steel. It is braced with angular two-inch pipe members measuring about 6½ feet long. The back sides of the two legs are trussed with one-inch pipe welded to each leg near the bottom and at the top, and span two intermediate supports welded to the legs.

Base of the mast consists of one piece of 2½ x 2½-inch angle iron about two feet long. Anchor bolt holes have been drilled at each end so the base can be bolted to the concrete foundation and held firmly in place. Four guy wires attached to the square platform on top extend outward at 45-degree angles to hold the mast steady so that one of the crew can climb the unit when attaching the pulley and line. Ladder rungs made of one-inch pipe were welded to the legs at 15-inch intervals. The truss brace serves as a hand rail.

WHEN THE GOING GETS ROUGH—

GET A JENSEN

In those remote corners of the oil world where production problems are the worst, and service is miles, perhaps thousands of miles away — that's where a JENSEN Pumping Unit always makes friends.

A JENSEN is easy to install, easy to counterbalance. Seldom needs service, but on those rare occasions where parts are needed you get them quick. Because of simple design and mass production a JENSEN usually costs less.

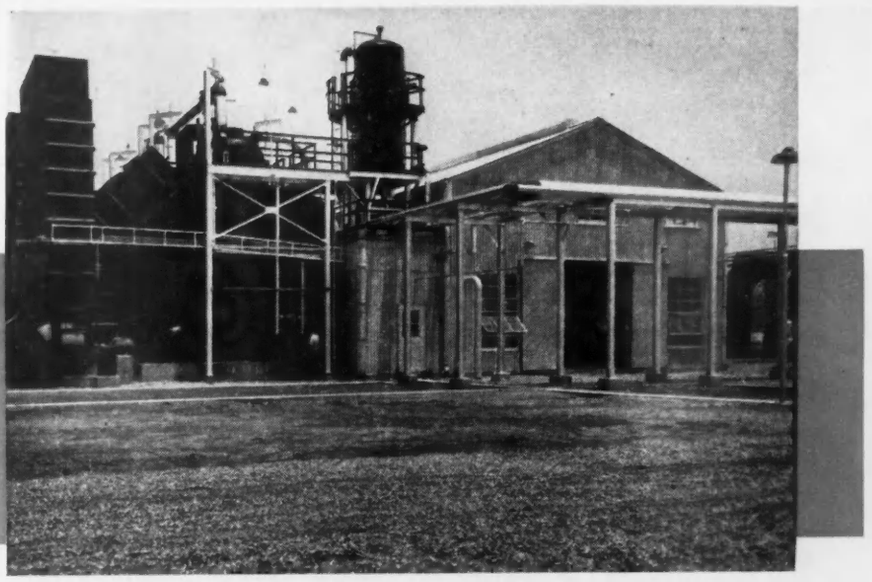
When the going gets rough—you'll be glad you got a JENSEN. See your nearest JENSEN dealer or write for complete specifications.

JENSEN

BROS. MFG. CO., INC., COFFEYVILLE, KAN.

EXPORT OFFICE: 50 CHURCH ST., NEW YORK CITY

TRANSCONTINENTAL GAS Pipe Line Company has applied steam power to large-scale transmission of gas for the first time. Three new stations with centrifugal gas compressors, now are using this venerable power source to obtain a highly flexible and efficient operation.



Power plant of compressor station at Eunice, La. Each of the two boilers can evaporate 43,000 pounds of water into 625 pounds per square inch steam at 750° F. every hour.

Steam-Powered Compressor Station

By DONALD M. TAYLOR
WORLD OIL Staff

THREE steam-driven centrifugal compressor stations recently were added to Transcontinental Gas Pipe Line Company's huge system which transports natural gas from Texas and Louisiana to New York. This, the first large-scale application of steam power to centrifugal compression of gas, is a pioneer step aimed at gaining substantial savings through highly efficient centrifugal compressors coupled to a flexible steam power source.

Though first of their kind, the stations cannot be regarded as experimental. Steam is a prime mover of long standing, and centrifugal gas compressors are being used by several gas transmission companies. Only the combination of these two elements is new. For this reason, Fish Engineering Corporation, designer and constructor of the new stations, was able to forecast accurately the operating characteristics of the stations; and early runs indicate these forecasts to be accurate.

The new stations, located at Eunice, La., Tylertown, Miss., and Billingsley, Ala., were designed to use slightly more fuel per horsepower than other Transcontinental stations, but this is offset by the high efficiency obtained by operating centrifugal gas compressors at low compression ratios and the small crews needed for maintenance and operation.

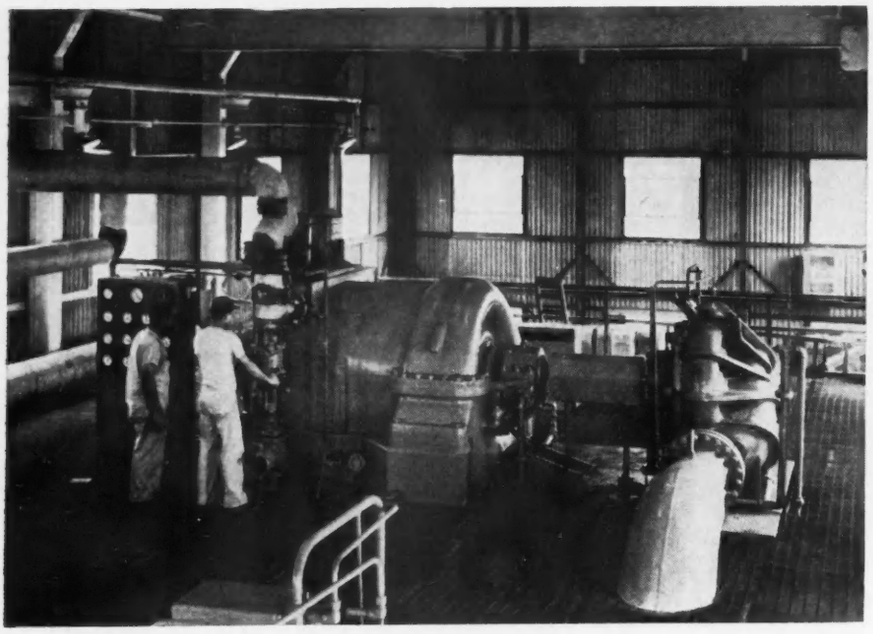
The station at Eunice, though smaller than the other two, is typical of the new installations. Two main structures make up the compressor station: a power plant and a compressor building. The power plant partially houses two automatically fired boilers and two 800-killowatt generators which furnish current for auxiliary equipment. Each boiler can evaporate 43,000 pounds of water into 625 pounds per square inch 750° F steam every hour. The compressor building houses the two turbine-driven blowers, each of which can develop almost 5000 horsepower under full load.

In addition to these two main structures, a water treating building houses equipment for treating three gallons of water per minute, which is the unusually low feed water requirement of two boilers; and a cooling tower supplies water for condensing steam. Office building, meter building, and tankage complete the station installation.

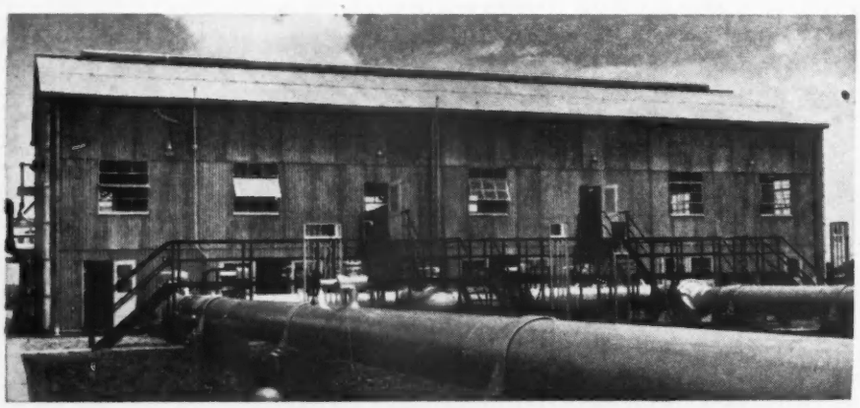
Compressor Building

So compact are the powerful turbines that, despite the comparative smallness of the building which houses them, the operating floor gives an impression of roominess. The wafer-shaped turbo blowers are only about four feet high and 1½ feet thick on the average. Their smallness is emphasized by 30-inch suction and discharge lines which swage to 12¾ inches at the blower flanges.

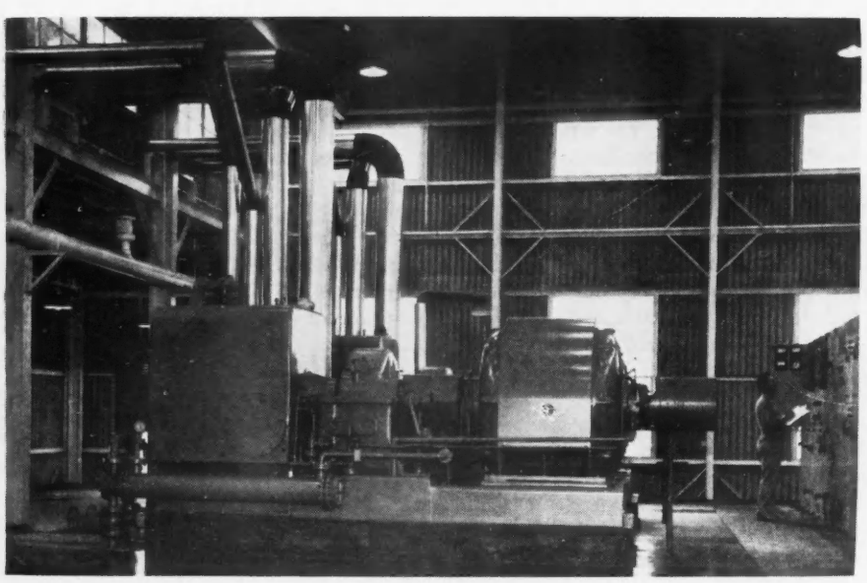
The blowers operate in series, one taking suction from the discharge of the other. The cases are steel-cast, volute type, housing a single stage, uncooled rotor mounted on one end of the shaft. Two thrust bearings mounted between seal bearings main-



Elmer Lively, operating engineer, adjusts throttle valve on a 5000-horsepower turbine as Marion Miller, repairman, stands by.



Compressor building at Eunice, La.



The 800-kilowatt turbine-driven generators. Operator at right is taking readings from switchboard.

tain alignment of the shaft. Because the impeller is overhung, sealing is simplified; the bearing nearest the impeller in conjunction with a sealing ring acts to prevent gas leakage from the blower casing. Gas leakage from impeller discharge back to the impeller eye is negligible because of a labyrinth packing at the impeller eye.

A multi-stage live steam condensing turbine drives the blower through a flexible coupling. The turbine is a composite impulse type with a two-velocity stage followed by a single velocity stage. A universal speed controller regulates steam flow through turbine admission valves, each valve admitting steam to a separate bank of first stage nozzles. All valves are actuated mechanically from a single power cylinder.

Steam leaving the turbines is condensed under a vacuum of 26 inches of mercury in gland type condensers located in the compressor building basement.

Lubricating oil plays an unusual role in operation of turbines and blowers. Besides lubricating bearings, it is used to shut down the turbines in case of overspeed and to seal high-pressure gas inside the cases of turbo blowers. A gear pump driven directly from the turbine shaft furnishes oil for lubrication and regulation. Oil for sealing gas in the blower case is supplied by a separate motor-driven gear pump which takes suction from the lubricating oil system. This seal oil circulates through the seal and bearing nearest the impeller at a slightly higher pressure than that of turbo blower discharge gas, thus providing a positive control of blower leakage. An auxiliary turbine-driven centrifugal pump under control of the automatic governor provides oil for starting, stopping, and in case of failure of the main oil supply.

A novel means of supplying seal oil in emergency was affected by locating a reservoir tank in top of the compressor building. High-pressure gas piped to the top of this tank plus static head gained by almost 30 feet in elevation, combine to provide sufficient pressure to seal gas inside the blowers during a short time emergency operation. Of course, complete failure of seal oil instantly shuts down operation of turbines and blowers.

A balanced trip-throttle valve also is actuated by oil pressure. When lubricating oil pressure drops below 20 pounds per square inch, this valve trips and shuts off steam supply to all the turbines and at the same time closes suction and discharge valves. Interlocked with the trip-throttle valve is a knockout valve which cuts off oil supply to the turbine in case

of 10 percent overspeed. Cutting off the oil supply actuates the trip-throttle valve to shut down the turbine.

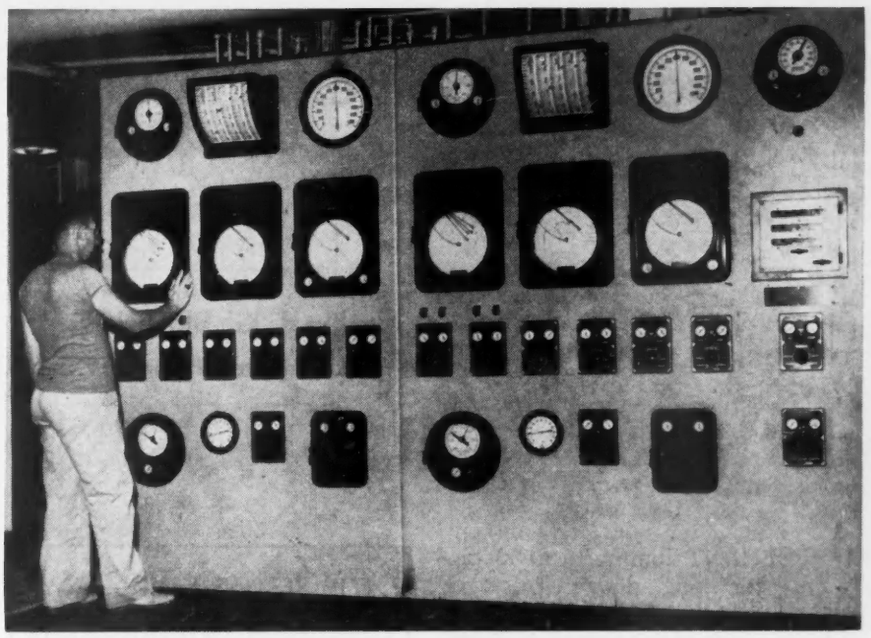
The entire compressor building is highly instrumentized, requiring little attention from operators. In addition to automatic shutdown controls, other instruments permit accurate control of turbine and blower operation and even control of boilers located inside the power plant.

Power Plant

The power plant is almost completely automatic in operation. Instruments automatically adjust the flow of fuel-gas and air to the firebox and feed water to boiler tubes to maintain constant steam pressure despite wide variations in load. These same instruments maintain a higher degree of fuel economy during variable load operations than could be achieved by hand operation.

The master instrument in this hookup is an indicating pressure controller tied in to the outgoing steam supply line. Any increase or decrease in load demand first will be reflected in a change in steam pressure, and this instrument performs the first step in adjusting the boiler output to the load.

For example, if a sudden increase in load demand causes steam pressure to fall, the instrument immediately counters by opening the fuel-gas valve, and signaling the gas-air ratio controller that more air is needed for combustion. The ratio controller opens a damper on the forced-draft duct, permitting more air to enter the firebox. When increased combustion builds up increased pressure in the firebox, another instrument opens the damper on the induced-draft duct, forcing additional combustion products up the boiler stacks. Since more steam calls for more feed water, a control valve on the feed water system allows more water to enter the boilers. At the same time, a controlled amount of water is forced into the de-superheater to control steam temperature. Thus, the boiler adjusts itself to new load conditions. So efficient is this instrumentation that only one man is required to operate the entire power plant, and his duties are primarily concerned with making routine equipment checks.



Instrument board which automatically operates the boilers is being checked by Herbert J. Young, auxiliary engineer.

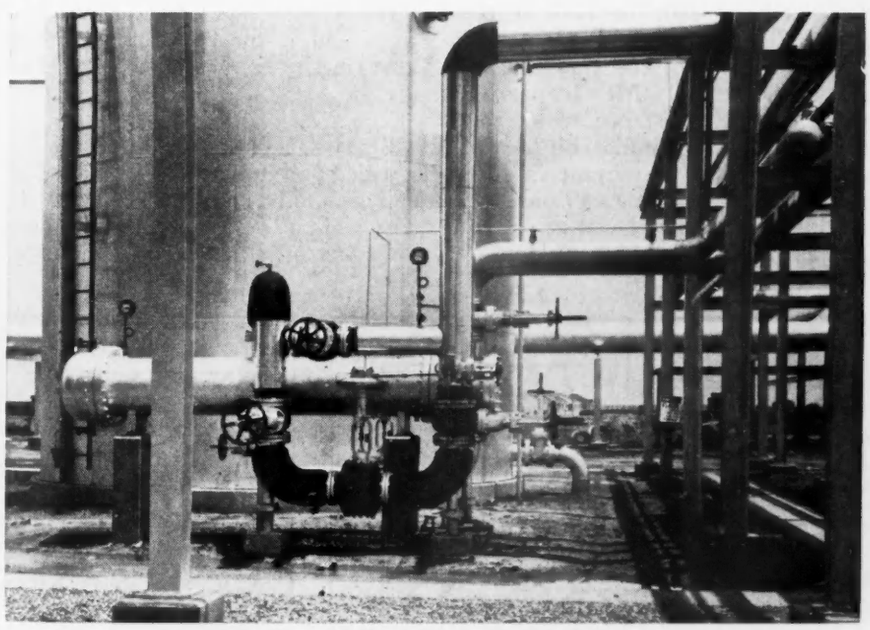
Manual Operation

The designer also made provision for manual operation of the boilers. Selector valves coupled to each boiler control instrument permit all control valves in the system to be operated by an individual instrument on the power plant control board.

Other instruments connected with the boiler plant control de-aeration and condensing of steam, and the operation of the turbine driven generators. These two 800 kilowatt generators, which supply current for electric motor driven pumps, are controlled from the main panel board of the power plant; and the various pumps driven by the generators also are controlled from the power plant switchboard.

This high degree of instrumentation and electrical control permits a minimum of operating personnel, and at the same time assures efficient operation. The net effect of these extensive controls applied to flexible steam power source is that even during the critical startup period, regular operating forces were able to handle the station with ease.

All three of the new steam-powered stations are now on the line moving gas at high capacity, and proving that steam power is an excellent power source for gas compression.

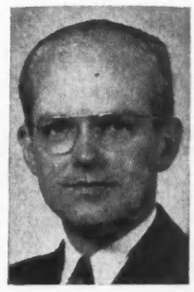


Excess steam condenser is another water economizer. Water make-up for steam system is less than three gallons per minute.

Late Developments in Piston Ring Design

By H. G. BRAENDEL

Chief Engineer, Wilkening Manufacturing Company, Philadelphia



THE PISTON RING performs one of the most difficult functions of the engine, sealing under high temperatures and pressures at relatively high sliding speeds with very little lubrication. Recent improvements in piston ring design have made more efficient engine operation possible.

RECENT improvement in piston ring design for large diesel and gas engines provides the means for operators to improve engine efficiency, lower oil consumption, and extend the period between engine overhauls.

The two basic functions of piston rings is to seal against passage of gas moving downward, and to prevent excessive oil from traveling upward. For these two distinct functions two types of rings are employed, namely compression and oil rings. Oil rings, with the exception of the bevel scraper type, are designed to perform only one function—the metering of a small amount of lubricant to the compression rings. Compression rings, on the other hand, are designed to provide a seal against downward passage of gas during explosion strokes and to serve as oil carrier rings in the two-cycle engine and as oil control rings in the four-cycle engine. Thus, the combination of oil and compression rings is interdependent and furthermore dependent upon the proper design of the piston.

Types of Compression Rings

For many years all compression rings had a plain rectangular cross section (Figure 1). These rings performed satisfactorily in low output engines, but with the increase in engine horsepower and improvement in design techniques, they have been superseded by the following types of rings made with a small width. Regardless of the type of ring, the narrow ring is less subjected to scuffing, will seal better, and last longer than a wide ring.

TAPER-FACED RING: The outside surface of the taper-faced ring is machined one-half to two degrees angle (Figure 2) in such manner that the lower edge of the ring contacts the cylinder wall first. It provides quick seating, resistance to scuffing, and considerable initial oil control action, which is important in four-cycle engines. The ring will slide over the oil film during the upstroke and scrape oil on each downstroke.

TWISTED OR TORSIONAL RING: This ring has a bevel or counterbore at the top inside diameter which induces it to twist when compressed to cylinder size so that the lower edge of the face contacts the cylinder wall (Figure 3). This twist also causes the ring to seat along a line close to the inside diameter on the lower side of the groove during the firing and compression strokes and along a line close to the outside diameter during the induction stroke. The bottom edge initial face contact gives the ring quick seating and anti-scuff characteristics as well as initial oil control. The high pressure line contact with the side of the groove provides a much better seal against the passage of blowby around back of the ring than is possible with a plain compression ring.

TAPER-FACE TWISTED RING: This ring combines the design features of both taper-face and twisted rings and is the best four-cycle engine ring for use in top grooves (Figure 4).

SEAL-CUT RING: This ring has a sealed gap in place of the plain butt gap generally employed (Figure 5). The seal-cut design can be combined with any of the aforementioned fea-

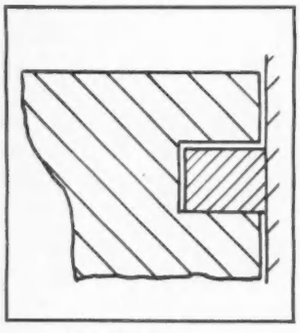


FIGURE 1. Plain compression ring.

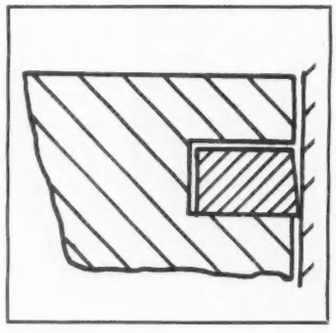


FIGURE 2. Taper-face ring.

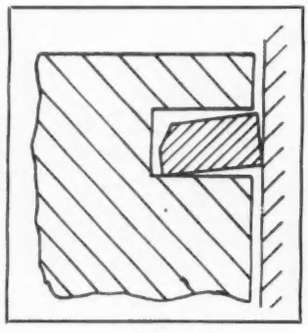


FIGURE 3. Twisted or torsional ring.

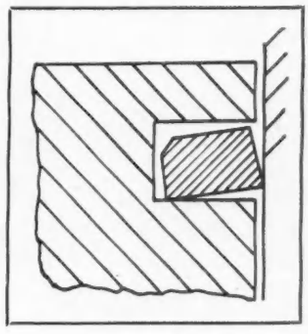


FIGURE 4. Taper-face, twisted ring.

tures. It is employed in very slow moving engines where the seal will reduce the loss of gas through the gap and in badly worn cylinders where a wide unsealed gap would permit a high rate of blowby.

SILTEX OR FILLED RING: This ring was developed for two-cycle engines. Its primary function is to carry oil. Its face is machined with deep grooves filled with a non-metallic porous substance which absorbs oil at the bottom of the stroke and retleases it to the cylinder whenever a temporary dry spot occurs (Figure 6).

Anti-Scuff Coatings on Compression Rings

All rings pass through a critical initial stage during which the surface of the ring must seat or mate with the cylinder wall. All up-to-date rings are provided with a surface coating which accelerates the seating and subsequently reduces wear. One popular coating imparts a multitude of small interruptions or pits to the surface which are filled with iron oxide and graphite which soak up oil. During the first few hours of engine operation the high points of this coating are sloughed off very fast to provide a rapid wearing in or seating of the ring. The pits filled with graphite and oil reduce wear to a minimum after initial seating has taken place.

CHROME-PLATED RINGS: Chrome plating of rings also will prevent scuffing, but such rings are definitely not quick seating. This surface is employed to increase the life of the entire ring and cylinder installation. Chrome plating the top one or two compression rings reduces wear of rings and cylinders from one-half to one-quarter as compared to the same installation where top rings are not chrome plated.

Unless chrome-plated cylinders are employed (which will give still better life than chrome plated rings) it is recommended that chrome top compression rings be used in all four-cycle engines. The same clearcut advantage does not exist in two-cycle engines because of a lubricating problem.

Chrome-plated rings should never be installed in badly worn cylinders. Since chrome is an extremely hard substance it will not seat readily in out-of-round or worn cylinders. Such rings should only be used if the cylinder taper is less than .0015 per inch of diameter.

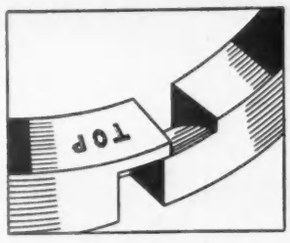


FIGURE 5.
Seal-cut ring.

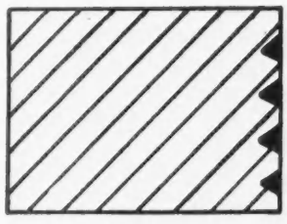


FIGURE 6.
Siltex or filled ring.

Oil Rings

A significant development in the field of oil rings is the conformable oil ring. Most cylinders are subjected to some degree of distortion, even when new, due to structural or thermal causes. The function of the oil ring is to scrape all excess oil but to meter a uniform thin film to the compression rings for proper lubrication. It cannot perform this function unless it is flexible and conformable. A standard single piece oil ring, no matter of what design, cannot effectively control oil in a distorted or worn cylinder. It is readily seen that a stiff ring will pass excessive amounts of oil along such sections of the cylinder which distort outward and will scrape excessively along narrow sections. The latter areas will, therefore, be too dry. Sections of the compression rings operating against the heavily scraped portions of the cylinder wall will be insufficiently lubricated, and localized scuffing and heavy wear will result. Since excessive oil may be passed at the same time at points where there is undue space between cylinder wall and oil ring, high oil consumption and heavy wear can result. This is characteristic of single piece, stiff, nonconformable oil control rings. Principal means to overcome the effect of high spots and localized dry areas in distorted and worn cylinders is to design the oil ring in such a way as to make it exceptionally conformable. Such a ring will exert uniform pressure against the cylinder wall regardless of the shape and change of shape of the wall, thereby preventing wear while simultaneously reducing the oil consumption to a minimum.

DUAL-DRAIN OIL CONTROL RING: The most successful design of such a conformable ring is shown in Figure 7. This ring has two slotted scraper sections made of cast iron supplemented by a steel expander. The sections are radially thin for maximum flexibility and have a hooked scraper edge which has a characteristic of practically maintaining the width of the cylinder contacting land as radial wear takes place. This is an important design feature. The oil control ability of a ring is directly dependent upon the unit pressure with which it is forced against the cylinder wall. If the land is so shaped that its width will increase as radial wear takes place, the ring will have the inherent characteristic of losing oil control as engine hours are accumulated. Unfortunately, most rings in use at the present time have this negative feature. This ring, therefore, has designed into it the means of maintaining oil control as engine hours are built up with the expander designed to give a unit pressure of 80 to 160 pounds per square inch. The exact range for each particular engine depends upon specific engine characteristics.

This ring is not only conformable radially but, because of the two-piece design, it is also conformable axially. If one scraping section is pushed from the cylinder wall, either by the hydro-dynamic pressure built up by a film of heavy oil or by a small irregularity in the cylinder, the top or other section will still remain in intimate contact with the wall.

A further improvement in the conformable oil ring which will soon be ready for the large engine field makes use of a new peripheral abutment-type equalizer which does not contact the bottom of the grove as does the humped steel expander. The equalizer provides absolute uniform pressure around the entire circumference of the ring which it contacts at an infinite number of points (Figure 8). As a result of this, there is no possibility of the equalizer losing its efficacy because of wear. It is designed with such low stresses that it takes no set during operation, which means that the equalizer will give the same tension after it has run for thousands of hours as it gave before it was placed in the engine. It is completely open, offering no chance for plugging. Since the equalizer contacts the ring around the entire circumference

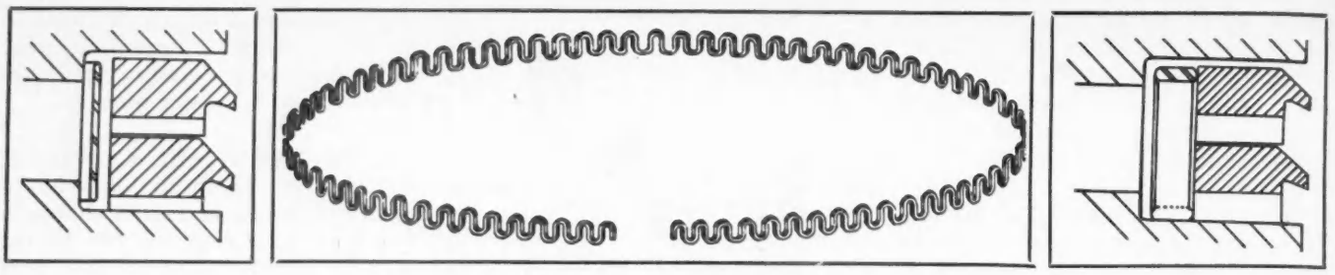


FIGURE 7 (left). Dual oil ring with standard expander.
FIGURE 8 (center). New-type peripheral abuttment "equalizer" or expander.
FIGURE 9 (right). Dual oil ring with peripheral abuttment "equalizer."

with uniform pressure, the cast iron sections can be made still thinner and consequently more conformable than is now possible with the hump type expander. (See Figure 9.)

These types of rings constitute the latest developments in design applying to large engines. As mentioned before, however, the rings in any installation are inter-dependent, and must be combined to work as a team to produce best results in oil and blowby control and reduced wear.

There are a number of practices in engine rebuilding procedure which merit further discussion. They concern the preparation of pistons and cylinders. Figure 10 shows a typical piston of a large four-cycle engine. This sketch describes three important details which greatly affect the performance of the installation with regard to oil control. All of these can easily be incorporated into a piston during the rebuilding procedure.

It will be noted that the bottom of the skirt is left sharp. This part of the piston has the ability to control as much oil as an additional oil control ring, provided the piston is fitted relatively closely and the edge is left as sharp as machining will permit. An angle of less than 90 degrees is preferable to a right angle at this point. In the case of some large pistons where handling may damage this edge, a very small undercut as shown on the sketch, will protect it from being damaged.

In many engines the specification of this important detail is neglected and in many cases the decision of whether to leave the skirt relatively sharp or rounded off is left optional with a shop. Yet the difference in oil control is considerable because, unlike the ring which depends upon its tension to maintain contact with the cylinder wall and, consequently, will collapse due to the hydro-dynamic pressure built up by excessive accumulations of oil, the piston skirt will strip the excess oil without collapsing.

The second important feature is that the oil ring groove be provided with abundant drainage for both lands of the oil control ring. As the ring moves downward, scraping the oil toward the bottom of the cylinder, the lower of the two contacting lands confronts the oil film initially. If there is no effective drainage of this relatively large quantity of oil being scraped, the hydro-dynamic pressure built up will lift the land from the cylinder wall. Since most oil rings now employed are of the single piece, double-scraper type the upper land will likewise be lifted from the cylinder wall after the ring has been subjected to a slight amount of twist. The lack of drainage for the lower land, therefore, impairs the ability of both lands to control or meter the oil. This again, is a small detail often overlooked, but easily incorporated in piston repair which greatly improves the oil control ability of the of the installation. It makes it possible to design the oil control ring without resorting to very narrow lands and extremely high ring tensions and, therefore, results in a longer-lived installation.

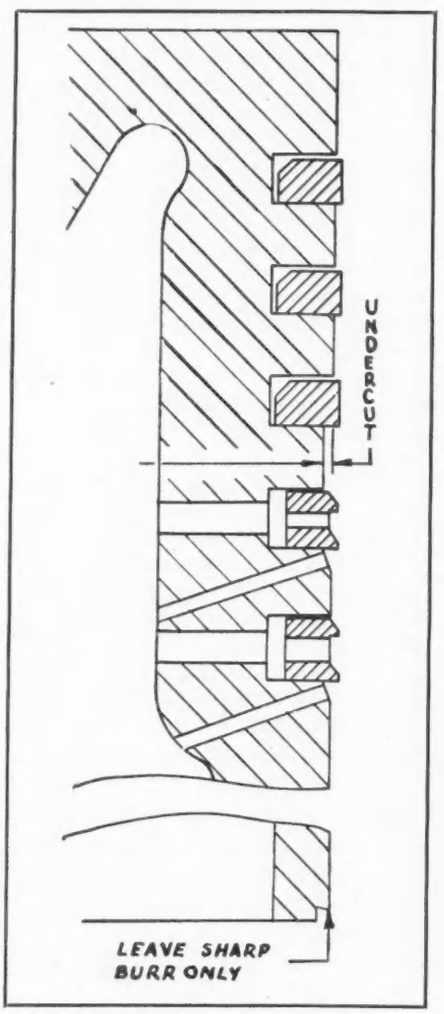


FIGURE 10. Piston alterations which improve oil control in large four-cycle engines.

Just above the oil ring is another very simple detail which will result in considerable improvement of the oil control ability of the assembly in a four-cycle engine. As mentioned before, the compression rings in a properly designed ring combination must control the oil which must be metered to them to provide for their proper lubrication.

Since the compression rings are such an important factor in the oil control in a four-cycle installation, any design detail on the part of the piston which will make this function easier will immediately result in improvement in oil control. On this sketch you will note an undercut of approximately 20 percent of the radial thickness of the ring on the land between the oil control ring and the lowest compression ring. This provides a reservoir for the oil scraped on the downstroke by the lowest compression ring. On each subsequent upstroke this oil may flow back to the inside of the piston through the side clearance of the oil ring. This small detail alone can be responsible for an improvement in oil control of as much as 50 percent. The latest direct comparative test made on this feature in a popular make engine resulted in an improvement of more than 60 percent in oil control.

A number of simple rebuilding practices which will improve the performance of the engines have been pointed out. The combination of employing the described piston design details with the latest types of ring in engineered assemblies will assure improved engine performance, longer life, less blowby, and better oil control.

THOUSANDS OF MILES of pipe line are being laid to carry oil, natural gas and refined products to the industrial and refining centers of the nation. Thousands of men are engaged in that task, which is among the most strenuous and hazardous occupations connected with the oil and gas industry. As a service to those men and to the pipe line construction industry in general, H. C. Price Company, through WORLD OIL, makes available safety rules which it has prepared and found effective in reducing accidents during the many years it has engaged in pipe line construction work.

Safety Rules for Pipe-liners

By B. G. PIERCE

Safety Director
H. C. Price Company
Bartlesville, Okla.

WITH the advances made in recent years in construction methods of large diameter oil and gas pipe lines, the rate of progress has been increased from a few thousand feet per day to as much as two miles per day. These expanded operations mean an ever-increasing number of workmen along with increased hazards which must be met by better supervision and cooperation in safety efforts.

A review of accident records indicates that carelessness on the part of employes is in most instances the contributing factor to accidents. At least a part of the responsibility for every

accident must be accepted by the supervisory personnel as an indication of inadequate instruction or improper supervision. The number of accidents in any group of employes definitely reflects the safety efforts of the supervisor.

It is the duty of the superintendent or foreman to see that all work is carried out in the safet possible manner in order to hold the injury rate to a minimum. This can be more effectively obtained by adequate instruction of all workmen in the proper method of doing their job and what kind of accidents they may expect in the type of work they are performing. Such instruction should be given at the time men are employed, and again from time to time as the nature of the employe's work changes.

The following safety rules designed especially for pipe line workers and contractors cover the most important matters as they relate to safety of operation and are designed to provide suggestions for lessening hazards of pipe line construction work.

Bulldozer Operations:

The bulldozer shall not operate on right-of-way until the brush gang is in the clear.

Where bulldozers are used in clearing operations, they shall be equipped with a "headache rack," to protect the operator from falling trees, etc.

The operator shall keep the swamper within sight at all times.

No employe other than the operator shall ride on the dozer unless authorized by supervisor in charge.

Ditcher Operations:

Machine parts shall not be greased while the machine is in operation.

Cleaning or adjusting of moving parts shall not be done while machine is in motion.

Operators and swampers shall not climb about the machine while it is in motion.

Underground power lines, pipe lines, etc., shall be properly spotted before any ditching operations are started.

Dragline and Backhoe Operations:

Machine parts shall not be greased while the machine is in operation.

The swamper shall stand clear of the cab and bucket, and keep all other workers and equipment clear.

The operator shall keep the swamper within sight at all times.

No employe other than the operator shall be in the cab while the machine is in operation.

Operator and swamper shall continually watch for overhead power lines and the boom shall never be brought closer than six feet to any power line.

Underground power lines, pipe lines, etc., shall be properly spotted before any ditching operations are performed.

Backhoeing, especially on steep grades, is tricky business. Here a machine is cutting ditch in rocky terrain while tractors are used as anchors at the top of the hill.

Wire rope connections shall be of the approved type and inspection of the lines and connections made daily by the operator.

Tractor Operations:

No employe other than the operator shall ride on the tractor unless authorized by supervisor in charge.

The operator must be alert, making sure all is clear before going forward or backward.

No matter what the operation may be, lifting, lowering, backing, etc., the operator shall instruct his swamper to stand where he can see him at all times and must watch his swamper for signals to stop.

Pipe shall never be picked up or lowered while any worker is between the tractor and the pipe nor shall the pipe be carried over the heads of workmen.

The sideboom shall never be moved while a workman is in the falling radius.

Wire rope connections shall be of the approved type and inspection of the lines and connections made daily by the operator.

Sideboom pins shall be inspected daily by the operator.

Trucks:

Transportation of Materials and Equipment

Trucks are to operate not over a specified speed and the driver shall obey all traffic rules, including stops at railroad crossings, school zones and main highway crossings.

The trucks' brakes and steering devices shall be inspected weekly by mechanics, as well as rear vision mirrors, signals, clearance lights, etc.

Drivers shall keep arms in the cab at all times unless giving directional signals.

Trucks shall never be operated with over-capacity loads, nor with loose objects on the bed which will roll free.

A red flag shall be tied to equipment extending beyond the bed of truck or trailer.

Overhead clearance shall be assured before a truck driver attempts to pass beneath any overhead projection. A truck driver shall stop his truck and check overhead clearance unless clearance figures are shown on overhead projection and truck load height is known by driver.

Only one person shall be allowed to ride in cab with truck driver.

Each truck shall be properly equipped with red flags and flares.

Transportation of Employes

Trucks are to operate at a speed not exceeding 35 miles per hour and

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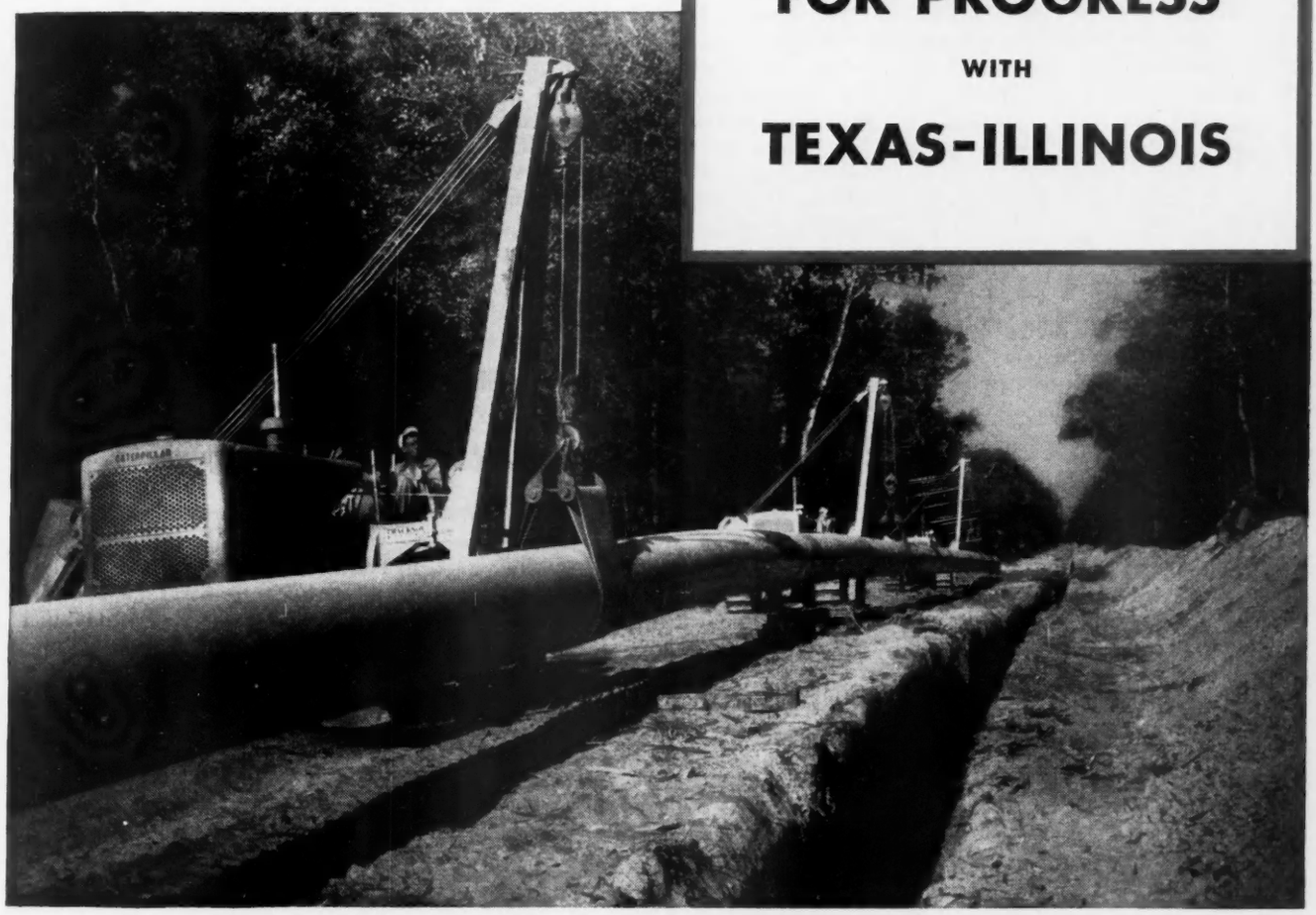

Texas Illinois Natural Gas Pipeline Company's 30-inch line, which will supply Old Ocean, Chocolate Bayou and LaGloria production to Peoples Gas Light and Coke Company in Chicago, is being strung, wrapped and laid for completion this fall.

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the driver shall obey all traffic rules, including stops at railroad crossings, school zones and main highway crossings.

Truck drivers are held responsible for the safety of workmen on their trucks.

Dog houses with recommended seating arrangement, securely boomed in place, shall be used when transporting workmen.

Workmen shall not ride with arms or legs protruding outside the truck body, standing on running board, seated on fenders or hood, seated on truck bed, seated on loose objects or on a load.

No workmen are allowed to get on or off a truck until it comes to a complete stop.

Only one person shall be allowed to ride in the cab with the truck driver.

Each truck must be properly equipped with red flags and flares.

Right-of-Way:

Power saw operators shall stay back of the saw and never reach in front of it to untangle vines, etc., while it is in motion.

All cutting tools shall be sharpened regularly and inspected daily for defects.

Workmen shall be kept out of possible falling zone of trees being felled.

All workmen shall be able to identify poison ivy.

Cases of poison ivy shall be reported immediately and the prescribed medical treatment given.

At all power lines, "Danger-Power Lines" signs shall be installed immediately after clearing has been completed. These signs to be placed 100 feet on each side of the power line in such a position that it may be seen from all equipment traveling the right-of-way.

Adequate fence gates shall be installed at all openings made in fence lines and closed upon completion of clearing operations.

The finished section of the right-of-way shall be left in the safest possible condition.

Trench:

No workman is to remain in the trench while heavy equipment is moving directly above his point of work.

Clear goggles shall be worn by all drill and jackhammer operators.

In blasting a trench near buildings, power lines and other improvements which could be extensively damaged by flying rock, a dozer shall blanket the dynamite string with a dirt cover. Care should be taken that no rock is mixed with the dirt used.

Pipe:

Workmen guiding pipe shall handle the pipe from the sides and never place hands on the ends.

Skids being carried up the line shall be securely boomed to the truck.

The foreman shall check the skids daily for defects and remove defective skids from service.

Skids shall be properly crotched to prevent pipe from rolling.

Workmen handling skids shall be required to wear gloves.

The correct lifting method shall be used and no attempt shall be made to lift an excessive weight.

Calipers, wire rope connections and clamps shall be inspected at frequent intervals by the operator.

Welding:

Necessary precautions shall be taken by the welder to protect himself when making a bell hole weld.

Welders shall wear the necessary protective clothing, helmets, goggles, etc.

The welder helper shall be furnished with the proper type eye goggles and he will be required to wear them.

Welders shall take the necessary precautions to protect other workmen or persons from flash burns when preparing to weld.

Cleaning, Priming, Doping and Wrapping:

Workmen handling or working around hot dope shall wear high-top shoes or boots with trouser legs on the outside. Also, they shall wear full length coat or shirt sleeves coming down over the top of the required gloves.

Workmen handling primer shall dress the same as those handling hot dope.

Workmen engaged in cleaning, priming and doping operations where fumes, rust, dust and other particles are excessive shall be provided with and shall wear eye goggles and respirators.

A suitable, approved ointment shall be provided for the workmen coming in contact with dope fumes and they shall apply it to the face and neck before work is started on each shift.

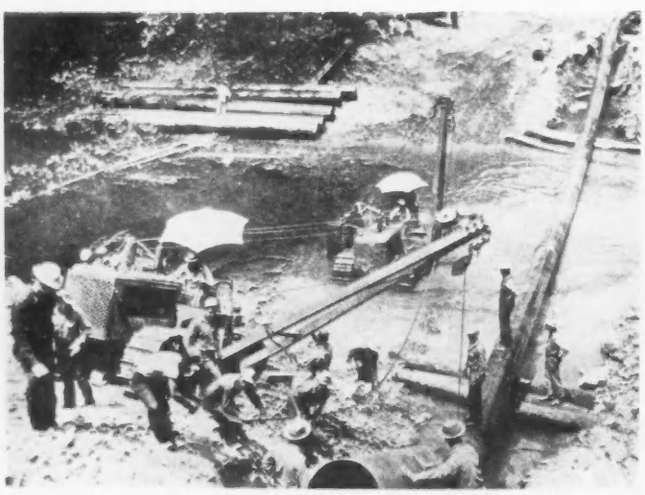
Where hot dope is carried in buckets, these shall be in good condition with good handles and shall be discarded at the first sign of a defect.

Workmen engaged in charging of dope kettles shall be provided with and shall wear suitable goggles to protect their eyes from flying particles when cutting the dope to size.

Burners on dope pots shall be cleaned and checked at regular intervals and operators shall be cautioned about "flash-backs."

All dope pots shall be equipped with down spouts and cutoff valves must be positive in their operation.

Suitable guards shall be kept on



Strong currents and washouts make pipe line river crossings hazardous. Exceptional care should be taken that all wire cables used in handling the extra heavy pipe are in first class condition.

All hands must keep alert and watch out for each other as well as themselves, in the handling of heavy pipe joints. Here a line-up crew is putting its weight behind a 40-foot joint.

In all types of lines... *everywhere*

REPUBLIC ELECTRIC WELD LINE PIPE goes together fast because it is *uniformly round, uniform in diameter, uniform in wall thickness.* It carries pressures safely because of its *uniform high yield strength.* It bends easily because it's made from *high ductility steel. Welds readily* because carbon content is low. *Free from scale* that might clog valves or contaminate products. Comes in *long lengths* that move jobs in bigger strides. *Inspected inside and out* to protect against possible hidden defects.

And, proved dependable by the more than 59,000 miles used for transmission, distribution, collecting and product lines during the past 22 years. Write for literature.

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Republic Electric Weld Line Pipe is made from flat-rolled steel, both sides of which are inspected. Thus, the surface which becomes the inside wall is free from hidden defects.

Republic
REPUBLIC STEEL
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Other Republic Products include Casing and Tubing—Carbon, Alloy and Stainless Steels—Studs, Bolts and Nuts—Heat Exchanger Tubes

moving parts of the machines which would constitute a hazard.

Lowering-In

All pipe lowering is to be done as directed by the foreman. Signals to the tractor operators and other orders must come from the foreman alone.

An adequate number of sideboom tractors shall be used to safely handle all lowering operations.

All belt slings and wire rope connections shall be checked before each lowering operation and the belt slings and boom lines shall be hooked to the boom while the tractor is moving.

No employe is to be in the ditch, on the pipe, or between the pipe and the ditch along the entire length of unstable pipe. (Pipe being lowered into the ditch and not supported by adequate skids is considered unstable.)

Workmen handling skids shall be required to wear gloves.

Defective skids shall be put out of service by the swamper of the skid pickup truck.

Highway and Railroad Crossings:

When equipment is being moved across a highway, a flagman shall be stationed a distance of 200 feet on each side of the crossing. Warning signs shall also be placed at the same distance.

Catwalks shall be placed over surfaced highways before cleated equipment is driven across.

Temporary bridges with guard rails on each side shall be constructed over excavations crossing highways and shall be of sufficient size and strength to safely support the maximum loads.

An adequate number of flares to assure proper warning to passing vehicles and pedestrians shall be placed at the crossing each night. A night watchman shall check these at regular intervals to see that they are kept in place and burning.

The road crossings must be properly leveled, shoulders repaired, and drainage ditches cleared before warning signs and flares are removed.

Equipment shall not cross railroads until flagman has indicated that it is safe to do so.

Shoring:

Where ditches traverse near buildings or heavy obstructions and there is possibility of cave-ins which might damage the foundations, adequate shoring shall be installed.

No workman is to remain in a ditch while heavy equipment is moving by his point of work.

About the Author

BENNIE G. PIERCE was born at Erie, Kansas, on December 25, 1911. After attending grade school and high school there, he continued his studies at Kansas State Teachers College, Pittsburg, Kansas. Before joining H. C. Price he was with Socony-Vacuum Oil Company at Kansas City, Mo., from 1932 to 1937 and then with Cities Service Oil Company, Bartlesville, Okla., from 1937 until 1943. He has been with H. C. Price since that time. He started his safety work while public relations director for H. C. Price in 1948.

Equipment Repairs:

Suspended machines, beneath which mechanics must work, shall be blocked or cribbed.

Adequate hoisting equipment must be used for repairs of heavy equipment or parts.

Gasoline shall never be used to wash equipment parts. Kerosine is recommended.

Repairs or adjustments shall not be made while equipment is in operation.

All guards shall be replaced on the equipment after repairs have been made.

Inflammable Liquids:

Gasoline shall be kept in a closed container having an adequate air vent.

Motors on the equipment must be stopped before fueling.

Smoking shall be prohibited while filling tanks with gasoline.

Fuel trucks shall be properly identified.

Fuel trucks shall be equipped with fire extinguishers.

The washing of equipment parts, hands or any object with gasoline is prohibited.

The fuel truck tank shall not be overfilled.

An outer tin covering shall be placed over the muffler of all fuel trucks.

The fuel truck operator shall check the tanks daily for leaks and see that the static chain is attached.

Explosives:

Separate magazines shall be provided for the storage of dynamite and detonators. These magazines shall be weather proof and adequately ventilated. The minimum distance between magazines storing dynamite and detonators shall be 100 feet.

Magazines shall be properly marked "Explosive — Keep Off." They shall be locked except when explosives are being put into storage or issued from same. One person shall be in charge of the magazines, although sufficient authorized persons should be licensed in order to insure constant supervision.

Only enough dynamite and detonators shall be brought on the job to meet requirements for that day.

A complete record shall be kept of all explosives issued or returned. Daily reports must be made and turned over to the field office to compile into a general record for the superintendent.

Those handling explosives or engaged in blasting operations shall know the federal regulations and explosive rules which are published by the manufacturers.

Checking the experience of the men in explosive work shall be the responsibility of the superintendent and the safe handling of this phase of the pipe line work shall be the responsibility of the foreman in charge.

First Aid:

All injuries shall be reported to the foreman.

Accidents, no matter how slight, shall be reported to the field office by the foreman.

The field office manager shall see that all proper accident forms are filled out completely and copies mailed to the insurance carriers and home office.

Each foreman's truck shall be equipped with an all weather first aid kit.

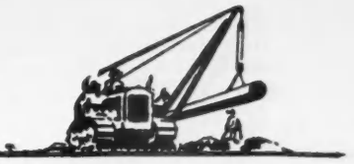
An appointed employe shall check first aid kits regularly for restocking and maintaining in good condition.

The foreman or a representative of each gang capable of administering first aid shall be responsible for first aid treatments.

ACKNOWLEDGMENT:

Grateful acknowledgment is extended to R.K. Shivel, G. A. Reutzel, W. B. Williams and J. J. Quinn for their assistance in compiling the above safety rules.

PIPE LINE *Construction*



By CECIL W. SMITH, WORLD OIL Staff

Projects Announced and Contracts Awarded

Crude Lines

Cities Service Pipe Line Company announced its plans to provide a pipe line outlet for the Malicky and T. C. I. fields of Pecos County, West Texas. The line will be 13½ miles of 4-inch pipe and will connect with Texas-New Mexico Pipe Line Company's line at the Abell station.

Gulf Oil Corporation has announced plans for the immediate construction of a 43-mile 6-inch pipe line originating in northeast Upton County, West Texas, and connecting with the Gulf's main system at Midland. It will serve the Spraberry producing areas of Upton, Glasscock, Reagan, and Midland counties.

Mid-Valley Pipe Line Company has announced it will construct a 20-inch spur from the southern terminal of its system at Longview to Wortham, Freestone County, East Central Texas, where it will connect with the "Big Inch" crude line from West Texas projected by the West Texas Gulf Pipe Line Company. The carrier would be 114 miles long and is scheduled for completion early in 1952.

Rancho Pipe Line System will be the name of 477 miles of 24-inch line now planned to reach from McCamey, Upton County, West Texas, to Deer Park, Harris County, Texas Gulf Coast. A multiple-ownership project, the line will be constructed and operated by Shell Pipe Line Corporation. Other owners will be: Sinclair Pipe Line Company, Pan American Pipe Line Company, Phillips Pipe Line Company, Nantucket Pipe Line Company (a subsidiary of Eastern States Petroleum Corporation, Inc.) and Tidewater Pipe Line Company (subsidiary of Crown Central Petroleum Corporation). At Genoa, near its southern terminus, Rancho will connect with a line running to Texas City for Pan American, and near Deer Park will connect with the refineries or terminals of the other owners. Completion is scheduled late in 1952 at an estimated cost of more than $35 million for a capacity of 209,000 barrels per day which can be upped to 315,000 daily with five additional stations making a total of eight.

Service Pipe Line Company has received Petroleum Administration for Defense approval to construct 50 miles of 12-, 16-, and 20-inch loop lines on part of its multi-line system between Drumright, Oklahoma, and Freeman, Missouri. Fifteen miles of 20-inch will be laid north from the Drumright station, and 14 miles from the Blake, Oklahoma, station. Nineteen miles of 16-inch will be constructed between Kansas City and Sugar Creek, Missouri. The 12-inch will be a short lateral from the system to Neodesha, Kansas.

Products Lines

Ohio Oil Company has authorized the construction of 24 miles of 8-inch line from its Wood River, Illinois, refinery to the East St. Louis, Illinois, market area.

Shell Oil Company is planning to construct 235 miles of 14-inch pipe line from its Wood River, Illinois, refinery to Chicago, and also an 8-inch extension from Chicago on to Detroit. The 14-inch would replace a present 8-inch carrier to Chicago and the smaller pipe would be raised for relaying to Detroit.

Natural Gas Lines

Amere Gas Utilities Company has made application to FPC for authorization to build 33.6 miles of pipe line in Wyoming, Mercer, and Raleigh counties, West Virginia.

Iowa-Illinois Gas and Electric Company petitioned FPC for a permit to lay 41 miles of 10-inch pipe from the Natural Gas Pipeline Company of America's system in Washington County, Iowa, to Cedar Rapids.

Mississippi River Fuel Corporation has filed an amended application with the FPC in connection with its proposal to develop the Waterloo, Illinois, oil field into an underground storage reservoir for natural gas. New proposal asks for 16.2 miles of 12- and 24-inch feeder and withdrawal lines in this Monroe County field. Original application asked for nine miles of 24-inch.

Montana Power Company has applied to FPC for permission to build 52 miles of 16-inch gas line from the Canadian-Montana border to near Cut Bank, Montana. A subsidiary, Canadian-Montana Gas Company, would build another 18 miles northward to the Pakowki Lake gas area in Alberta, Canada.

Northern Natural Gas Company has received temporary authorization from FPC for 79.5 miles of 26-inch pipe line and 27,200-hp to be installed on the company's system in Texas, Oklahoma, Kansas, Nebraska, Iowa, and Minnesota. That was only part of the original request for 221.8 miles of 26-inch and 84,000-hp in compressor capacity. G. G. Griffis, Inc., Tulsa, has had the contract for the entire pipe work for some time subject to FPC approval.

Pacific Gas & Electric Company obtained temporary FPC authorization for the laying of 44 miles of 8-inch line from a point south of Salinas, Monterey County, to King City, California.

Permian Basin Pipe Line Company of Delaware is planning to build a 375-mile 24- and 30-inch gas system from Hobbs, New Mexico, to the Texas Panhandle. The line will serve the Northern Natural Gas Company and other pipe line companies in the Panhandle gas fields. Capacity of the carrier would be 300 million cubic feet per day, and construction is scheduled for an early 1952 start and completion in September.

Rockland Light and Power Company applied to FPC for permission to build 22 miles of 8-inch line to receive gas supplies from Transcontinental's system at Orangeburg, New York, for transmission to Tomkins Cove, N. Y. Cost would be $753,315 and capacity would be 11 million cubic feet daily.

Southern California Gas Company and **Southern Counties Gas Company** have jointly asked FPC for permission to build 23.5 miles of 30-inch pipe line from Inglewood to Los Angeles, California.

Southern California Gas Company and **Southern Counties Gas Company** made application to FPC for permit to install 81 miles of 30-inch loop lines between Desert Center and Whitewater, California, and six miles of 30-inch loop from the California-Arizona border to the Blythe compressor station. Included in the application was additional 3520 hp at the Blythe station.

United Natural Gas Company recently received authority from FPC to lay 10 miles of new line in Venango, Elk, and McKean counties, Pennsylvania, and replace eight miles of line in Elk and Venango counties. Also included were additional 150-hp units at both its Hickory station, Forest County, and Pinegrove station in Venango County.

Projects Starting

Crude Lines

Interstate Oil Pipe Line Company has Houston Contracting Company, Houston, at work on a 115-mile 6-, 8-, and 12-inch take up and lay job in the New Iberia vicinity of South Louisiana. Included are 35½ miles of 12-inch to be laid between Sunset and Jeanerette stations, and 3½ miles of 8-inch and 17 miles of 6-inch branch lines to the Avery Island and Weeks Island fields of Iberia Parish.

Service Pipe Line Company has Smith Contracting Corporation, Fort Worth, and O. R. Burden Construction Corporation, Tulsa and Wichita Falls, at work on 123 miles of 10-inch pipe line running from Haskell County, North Texas to Service's system at Bowie, Montague County. Smith has the first 57 miles from Jud station, Haskell County, to the west bank of the Salt Fork

Brazos River, and Burden is laying 66 miles from the river to Bowie, including the crossing. Both contractors got underway during July.

Products Lines

Phillips Petroleum Company has a 500-mile 8-, 10-, and 12-inch looping program underway on its Texas Panhandle to East Chicago products system. Between Borger, Texas, and Paola, Kansas, 163 miles of 12-inch will be laid. The 10-inch totaling 137 miles will be installed between Paola and East St. Louis, and 198 miles of 8-inch will be built between East St. Louis and East Chicago.

American Republics Corporation contracted with W. L. Golightly, Inc., Houston, to build 42 miles of 3- and 6-inch line from the East Village Mills field, Hardin County, Texas Gulf Coast, to the company's cycling plant, north of Silsbee. Work on right-of-way started the first of July.

El Paso Natural Gas Company has its company crews at work on the final 32-mile leg of its 24-inch line from the San Juan Basin to the California border. This section runs from Kingman to Topock, Arizona, and was the portion held up because of the Department of Interior's refusal to allow crossing of public lands without an agreement to common carrier provisions.

Kansas-Nebraska Natural Gas Company, Inc., employed Jay Hawk Construction Company, Great Bend, Kansas, to build 66 miles of 6-inch line in Nebraska. The spread got underway during July.

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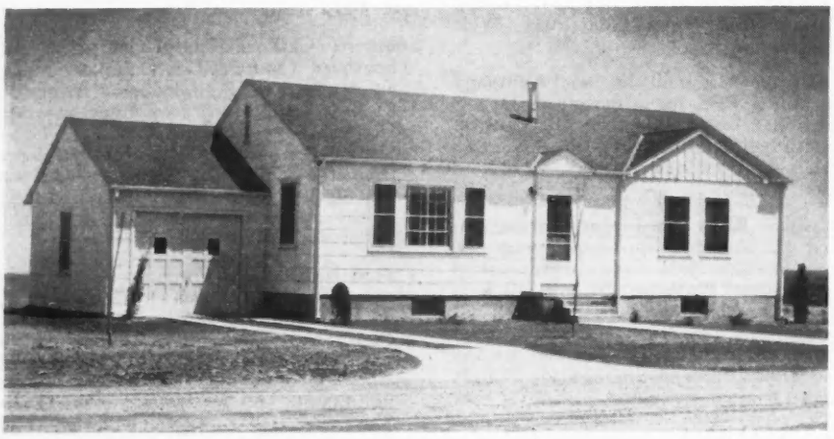
Modern home or complete oil field camp. Delivered and erected anywhere. One purchase order handles design, building, transportation and erection. Immediate delivery . . . no delay. Write for complete information today.



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STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

Kansas Power & Light Company in July started 30 miles of 20-inch and 12 miles of 8-inch pipe line in the Pratt, Kansas, vicinity. M. E. While Company, McPherson, Kansas, is doing the job.

Mississippi River Fuel Corporation had the Houston Contracting Company start 98 miles of 16- and 18-inch line between the Woodlawn field, Harrison County, East Texas and the California Company plant in Lincoln Parish, Louisiana. Included in the job are 11 miles of 10-inch lateral line from the Waskom field to the larger line. A new gathering system in the Woodlawn field will also be built by Mississippi.

Panhandle Eastern Pipeline Company is having 22 miles of 30-inch line laid between Hume, Illinois and Montezuma, Indiana, by Contracting and Material Company, Evanston, Illinois. Job got underway in mid-July and is expected to be complete by the first of September.

Southern California Gas Company employed Alex Robertson Company, Paramount, California, to lay 15½ miles of 30-inch line in Los Angeles County. Work started in June.

Southern California Gas Company has Engineers Limited Pipeline Company, San Francisco, laying 7½ miles of 30-inch line in the Los Angeles vicinity.

Texas Eastern Transmission Corporation awarded the following contracts and had all get underway during July: 79½ miles of 30-inch line from Cumberland River to Columbia, Kentucky, to Oman Construction Company, Inc., Nashville; 82 miles of 30-inch from Columbia to Boonesboro, Kentucky, to N. A. Saigh Company, Inc., San Antonio; Kentucky and Cumberland River crossings to Pentzien, Inc., Omaha; 76 miles of 30-inch from Tennessee River to Columbia, Tennessee, to Eastern Pipe Line Contractors, Dallas.

Projects Completed

Crude Line

General Petroleum Corporation completed 42 miles of 4-inch and 42 miles of 8-inch pipe line from San Ardo field, Salinas Valley, to Estero Bay near San Louis Obispo. Bechtel Corporation, San Francisco built the line.

Natural Gas Lines

Hope Natural Gas Company completed 32½ miles of 8-, 10-, and 12-inch line from the Terra Alta field to Hope's system near Fairmont, West Virginia. Pipeline Construction & Drilling Company, Camp Hill, Pennsylvania, did the work.

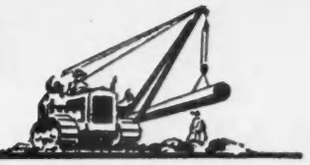
Kansas-Nebraska Natural Gas Company, Inc., completed 128 miles of 6-, 8-, and 10-inch line in Nebraska, with Jay Hawk Construction Company laying the line.

Oklahoma Natural Gas Company had Western States Construction Company, Oklahoma City, build 19 miles 12-inch line in Logan County, Oklahoma, and which was completed in July.

Trunkline Gas Supply Company completed 184 miles of 26-inch line from Senatobia, Mississippi, to Joppa, Illinois. The contractor was R. H. Fulton & Company, Lubbock, Texas.

How to do it!

PIPE LINE HINTS



$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Weight Steel Sump Tank

Concrete poured around a partially buried steel sump tank prevents it from floating out of the soil in case of flood and gives added protection against corrosion.

Money is saved in the operation by excavating a round hole and pouring below-grade concrete "neat," using the soil as an outside form. Above grade, hard pressed fiber board is shaped into a circular form as shown, using 2 x 4's as studs and kickers. The fiber board extends about six inches below grade. Reinforced steel is placed around the tank and lugs are welded onto the sides to insure a bond with the concrete.

The tank is filled with water and weighted with sacks of cement to prevent it from floating when concrete is being poured around it.

HOW TO—Control Spoil Bank Size

Backfilling operations were simplified and right-of-way damages minimized when one contractor narrowed spoil bank width by mounting a plate over the end of the conveyor belt on a ditching machine.

Without the plate, spoil bank width usually exceeds the natural angle of repose for backfill because the cuttings are cast off the end of the conveyor belt. The increase in width is outward from the ditch. This means bulldozers and draglines must move backfill farther in filling the ditch. There is consequently more damage to right-of-way by backfilling operations and contamination of topsoil by subsurface soil.

Spoil bank width is reduced when a quarter-inch steel plate mounted at the end of the conveyor causes spoilage to drop vertically on the bank and assume the natural angle of repose. This plate is slightly wider than the conveyor belt and is mounted on two braces cut from heavy steel, the thickness of which depends on the size of the ditching machine. The braces are hinged at the lower end so that the plate can be lifted when backfill piles too high.

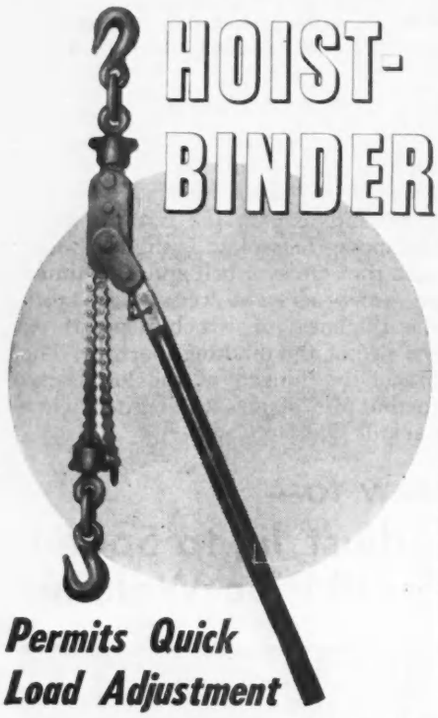
HOW TO—Adjust Jig to Speed Small Pipe Welding

Fabrication of small pipe is speeded by use of a welding jig which can be quickly adjusted for height.

The small welding jig shown has a set screw handle which permits height to be swiftly adjusted during fabricating operations. The handle is made of a 16-inch carriage bolt, the nut of which is welded to the outer 2½-inch sleeve of the jig. The bolt is then heated and bent to a crank-like shape and the round head removed with cutting torch.

The inner two-inch pipe sleeve, which has an angle iron trough on top to hold the pipe, can be raised to the proper height and held there by a turn of the crank. The tripod legs are made of one-inch pipe.

NEW RATCHET-TYPE HOIST-BINDER



Permits Quick Load Adjustment ... Continuous Take-Up

Your load is never "off the hook" when you boom it with a new Coffing Hoist-Binder. Operating on the ratchet hoist principle, the Hoist-Binder pulls load chain to any tension up to 3,000 lb. Takes up or slacks off 20½ in. (or more with longer chain) . . . provides ample length of pull to tighten down springy loads or re-secure those that have settled — without releasing hooks for another bite.

Entire operation — tightening and releasing — is controlled by the handle alone. No buttons to push, no levers to turn. Handle is removable, and when removed, binder becomes a tamper-proof lock. Ratchet and pawl construction holds securely in any position . . . prevents handle from flying up when released . . . permits full strokes for rapid take-up, half strokes for minute adjustment . . . free chains when not under load. The handle acts as a "safety valve," since it will bend before the binder is overloaded beyond safe limits.

Find out more about the binder that gives you extra convenience and safety.

Write for Bulletin 08HB.

COFFING HOIST Company

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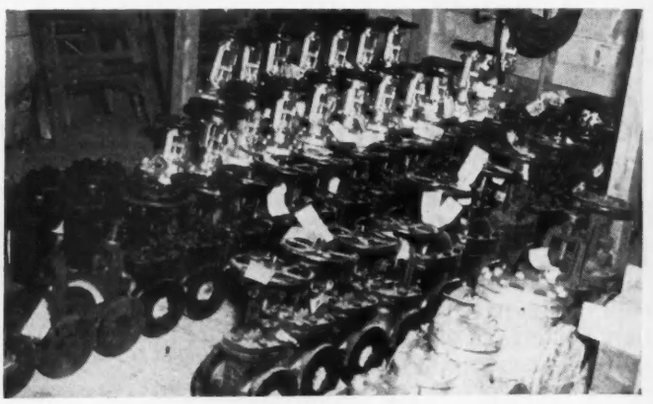
Quik-Lift Electric Hoists • Hoist-Alls
Safety-Pull Ratchet Lever Hoists
Mighty-Midget Pullers • Spur-Geared Hoists
Differential Chain Hoists • I-Beam Trolleys

HOW TO—Keep Track of Valves



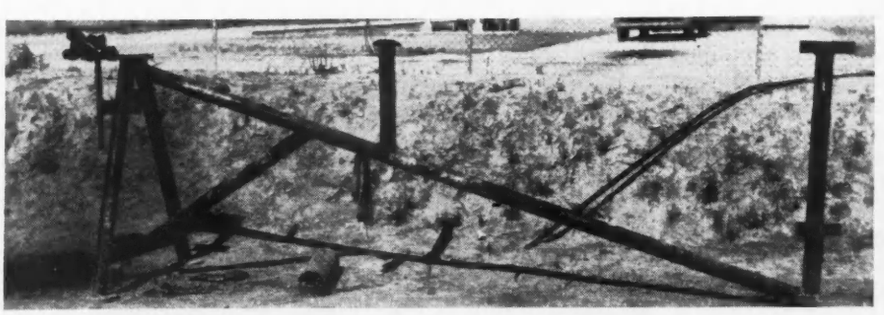
By tagging each valve with purchase order, construction print designation and accounting code when it was received, one company saves workmen's time, eliminates errors and speeds plant accounting during construction of a compressor plant.

Since most gas compressor stations come under Federal Power Commission jurisdiction, a strict accounting must be made of all materials installed during construction. A knotty problem is keeping up with the many small valves found in all compressor plants.

The pressure ratings of small valves found on compressor stations will usually range from 125 to 2000 pounds. Types include needle, plug, gate, globe, quick-opening and multiport valves, and even these can vary in body trim. Since each valve was ordered for a specific purpose, great care must be exercised during installation.

One company solves this problem by recording pertinent information on ordinary shipping tags attached to each valve, and then exercising rigid control over valve issues. When workmen requisition valves for field installation, a quick reference to construction prints enables warehousemen to issue the correct valve. The tags are left on valves during installation, and removed later by field draftsmen as completion drawings are made.

HOW TO—Make Pipe Threading Jig



A light pipe threading jig which can be easily transported about the station construction job can be fabricated from scrap two-inch pipe.

First an A-frame is fabricated to a height of about three feet and circular bearing plates of scrap steel plate welded to the bottom of the legs. A top plate of one-half-inch steel is sized to provide support for the pipe vice, and a ten-foot length of pipe is saddled into the top of the A-frame at such an angle that the A-frame will stand erect when the far end of the pipe is touching the ground. This piece of pipe is then braced to the cross member of the A-frame and risers are welded in vertical positions as illustrated. A short section of six-inch pipe is welded onto the top of each riser at the same elevation as the pipe vice to provide support for the piece of pipe being threaded, and to hold it in a level position.

Now...a ~~tested~~ proved method of welding multiple joint sections on the Right-of-Way!

This O. R. SMITH Submerged Arc Welding unit made up to 87 welds per day on the 26-inch line of the Trunkline Gas Company, Illinois.

High Quality Welds plus Efficient Operation!

The adaption of the O. R. Smith factory submerged-arc welding to field conditions has continued to maintain the highest qualities associated with this process. Numerous physical tests made on the line, and extensive X-ray examinations show that welds produced with the O. R. Smith unit are consistently high in quality and meet the most exacting inspection requirements.

For accurate and positive control over the quality of welding, O. R. Smith machines are equipped with meters which indicate the actual welding amperage, voltage, and welding speed. As a result of this precise control the O. R. Smith submerged-arc welding units produce welds with perfect fusion between the pipe and electrode. The flux coating retains heat in the weld long enough to insure perfect grain refinement, and give metal enhanced physical properties.

This O. R. Smith equipment makes possible the use of multiple joint sections of 2, 3, 4, 5, 6 or more joints. This new approach speeds the rate of pipeline construction which results in a reduction in the total overhead and operating expense. The table below illustrates how a tie-in crew making 50 welds per day can produce much greater footage by using multiple joint sections instead of mill lengths. For example, the welding time on 26-inch pipe is 4½ minutes, the handling time only one minute, thus making it possible to produce 85 to 100 welds per day with one O. R. Smith machine. Transportation costs of jointed sections are eliminated since sections are made down the right-of-way in the exact position where they are required.

Another highly important use for the O. R. Smith unit is for welding river crossing pipe. Here the increased wall thickness allows more welding time in proportion to set-up time, the handling being approximately the same regardless of wall thickness.

This equipment may be rented by contractors, refineries, oil, gas and pipe line companies, off-shore pipe lines, or any business associated with feeder lines from:

The Hauser Pipeline Equipment Co.
205 N. W. 7th St.
Fort Worth, Texas

Table Showing How Daily Footage is Increased Using Multiple Joint Sections

Scheduled Rates of Construction Using 40-ft. Joints	Total No. Welds Req. Per Day	Using 2-Joint 80-ft. Sections		Using 3-Joint 120-ft. Sections		Using 4-Joint 160-ft. Sections	
		Hand Weld	Auto. Mach. Weld	Hand Weld	Auto. Mach. Weld	Hand Weld	Auto. Mach. Weld
4,000 ft. per day	100	50	50	34	66	25	75
6,000 ft. per day	150	75	75	50	100	37	113
8,000 ft. per day	200	100	100	66	134	50	150

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O. R. Smith

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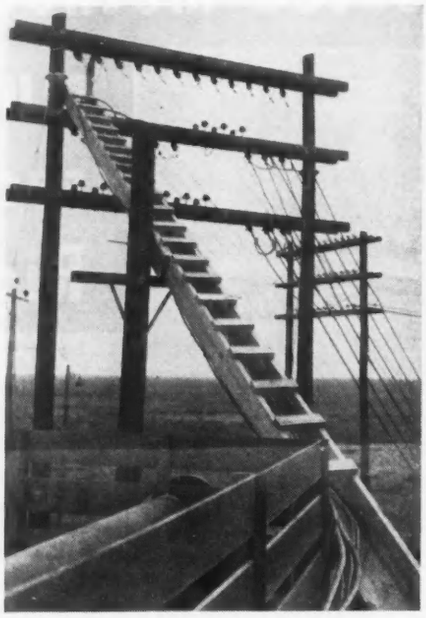
HOW TO—

Provide Temporary Conduit for Cable

A wooden trough served as a temporary conduit for electrical cables running to a cooling tower which continued operating while it was being expanded.

About 12 cables were required to furnish power for circulating pumps and fans on the cooling tower. When the expansion program started there arose the problems of protecting workmen from the high voltage cables and avoiding shutting down the cooling tower. Overhead lines could become entangled in construction machinery. Operating forces provided a solution by running all cables through a wooden trough as shown.

Sides of the trough were 2 x 8's nailed onto a 2 x 12 bottom. Twelve-inch lengths of 2 x 4's nailed at 16-inch intervals added rigidity to the



trough and also provided a ladder for electricians. The center of the trough span was supported by a temporary pole, later to be used as part of the permanent installation.

HOW TO—

Shield Floor During Construction Period

Pressed fiber sheets offer excellent protection for highly finished concrete floors during the final stages of constructing a compressor building or pump room.

In most construction jobs, the concrete floors are poured and finished long before small pipe work and painting are completed. Since blemish-free, highly trowelled floors contribute much to the general appearance of a compressor or pump building, it is necessary to protect them against nicks, scratches and oil stains.

Pressed fiber sheets one-half inch thick are used by one company for this purpose. The sheets completely cover the floors and fit snugly around the compressors and auxiliary pumps, furnishing protection against hot slag, nicks from falling pipe and oil spill-

PIPELINE
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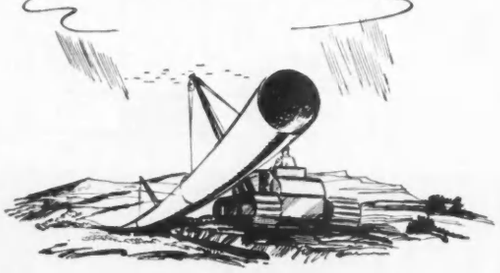

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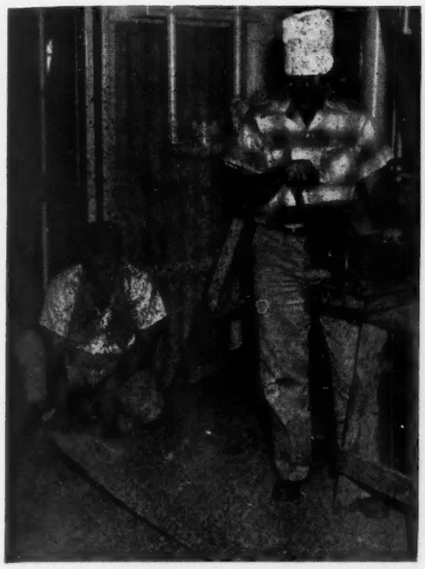

age. After the job is completed, the sheets bring a relatively high salvage price.

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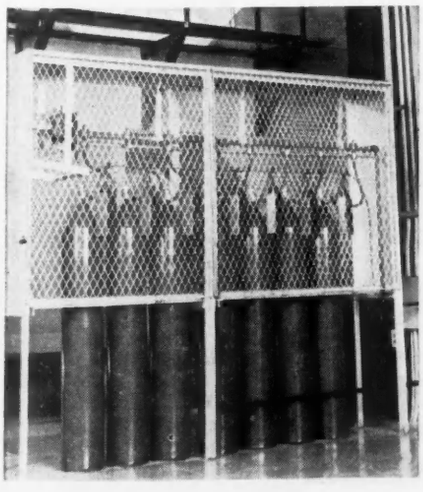
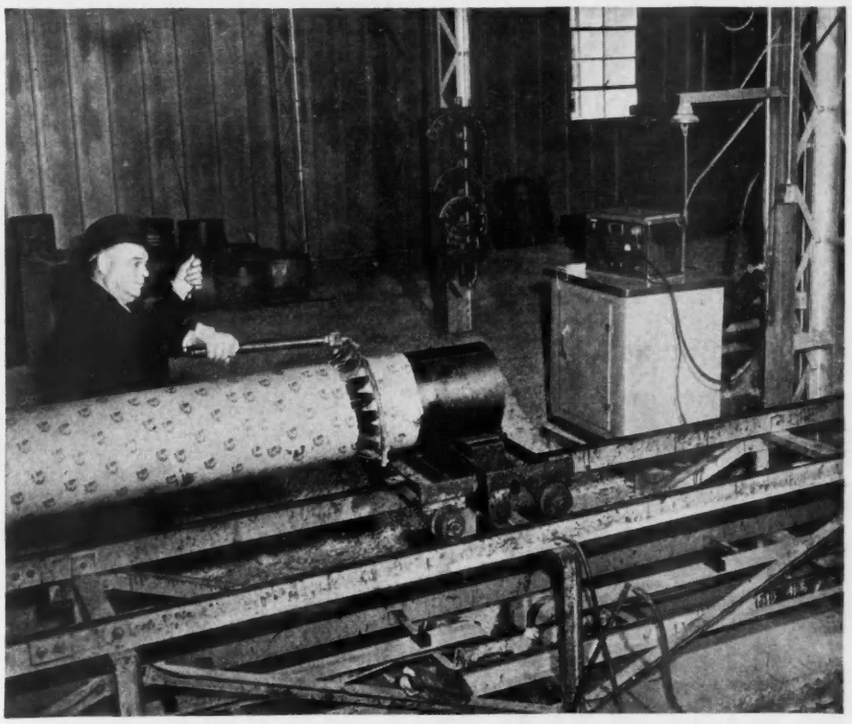
The triggers on the carbon dioxide bottles tied in to a fire extinguishing system in an auxiliary building can be protected from accidental discharge by an expanded metal cage mounted over the top of the bottles.

One company installed a framework of angle iron with sides of expanded metal as shown. The cage prevents workmen from accidentally tripping the triggers when cleaning around the bottles.

The sides of expanded metal may be removed from the frame when it is necessary to change bottles or otherwise service the installation.





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HOW TO—Install Valve Settings

In constructing pipe lines, it is practical to fabricate the individual valve settings as units in the pipe yard or warehouse, haul each to its site of installation, and there weld it in place.

For above-ground valve settings, a horzontal brace with ends butt-welded to the outside of the lower 45-degree ells should be added to the valve setting unit during fabrication. Such a brace adds rigidity to the unit, holds the lower ells in place, prevents springing out of shape, and holds the unit in line when internal pressure is applied after installation.

Hot pipe enamel is applied to the portion of each valve unit that will be buried. This is done immediately following unitized fabrication, and prior to final installation.

The illustration shows an assembled, above-ground 12-inch valve setting unit for a newly built natural gas pipe line of similar diameter being lowered by side-boom tractor into the ditch for final installation.

A space approximately equal to the longitudinal distance between the lower ends of the valve setting unit is left between the ends of the buried pipe line for fitting and welding the unit in place.

Bell holes, spaced at the proper distance, provide room for welding fitting the unit to ends of the buried pipe line.

A large carpenters level is used in plumbing and leveling the valve setting unit, before final welding.

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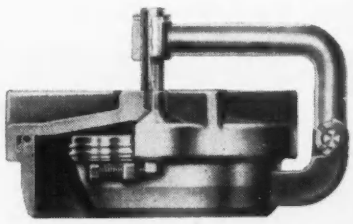

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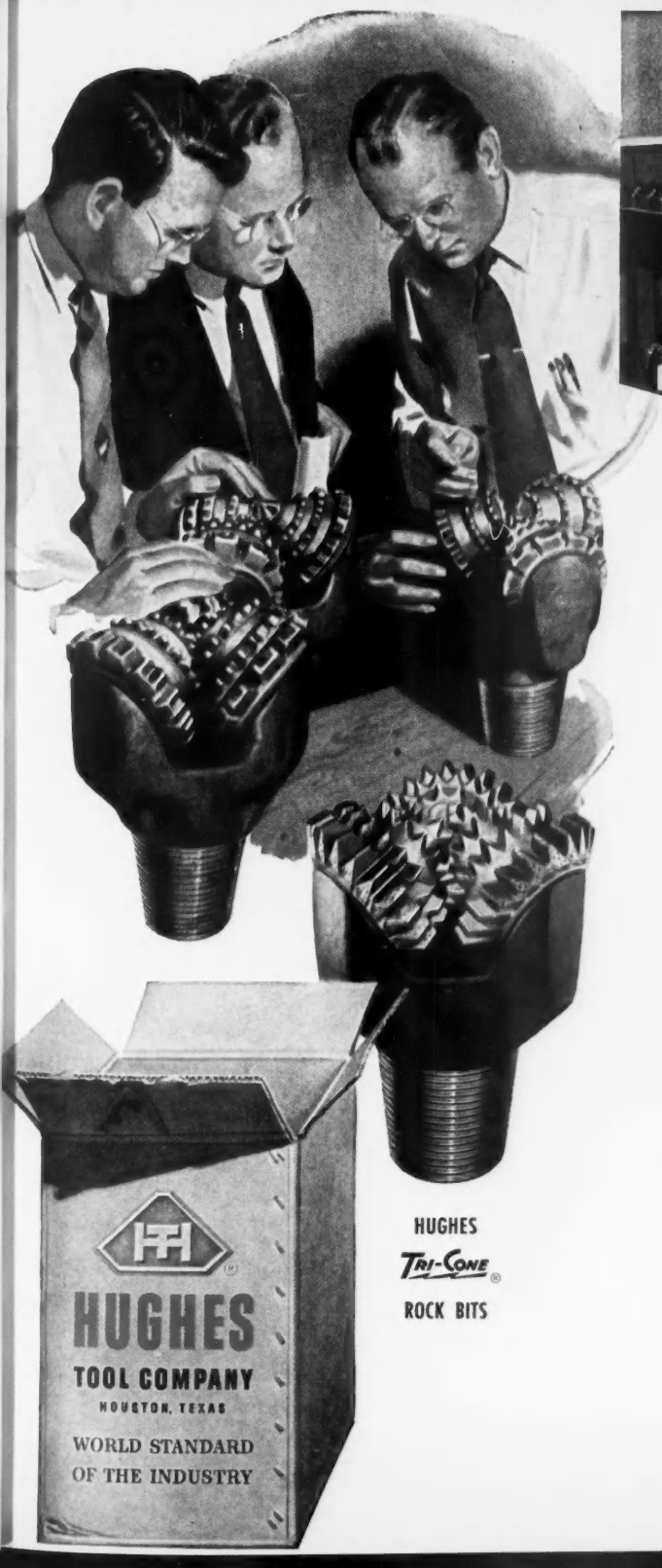

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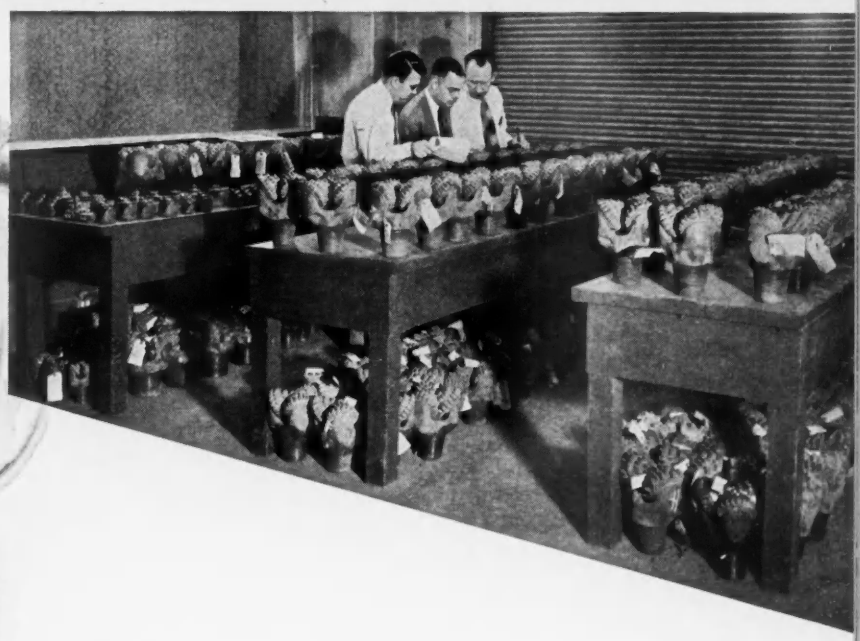

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COMPLETE DRILLING MUD SERVICE

Free Enterprise Oil Greases Wheels of Mexican Monopoly

By ROBERT E. SPANN
WORLD OIL Staff

DOUBLING of production during the past seven years makes Mexico's record outstanding among countries in which oil is operated as a government monopoly. However, generally ignored is that the increase is coming from properties expropriated 13 years ago from American and British companies, that no important fields have been discovered since nationalization of oil, and that the increase in output is due almost entirely to the fabulous Poza Rica field.

THIS ARTICLE draws attention to the generally-ignored facts that Mexico's production increase is derived from properties expropriated 13 years ago from American and British companies, that no important fields have been discovered since the nationalization of the industry, and that the increased output is due almost entirely to the prolific Poza Rica field.

The Poza Rica field had been found so shortly before expropriation that it was in swaddling clothes at the time, with only 16 wells completed. The field produced 18,620,000 barrels in 1937, last year of private operations in Mexico, a daily average of 51,013 barrels. Under Petroleos Mexicanos, the government's oil agency or department, an intensive drilling campaign in this proven area has permitted Poza Rica's production to be pushed to an average of 128,000 barrels per day in 1950. This represents an increase of 77,000 barrels per day for Poza Rica between 1937 and 1950, while production for Mexico as a whole was rising only 69,000 barrels per day. Poza Rica is more important to Mexico than all the oil fields of Texas are to total crude production in the U. S., accounting for 65 percent of the nation's total production.

Despite its strides during recent years, Mexico's progress has not equaled the accomplishments in countries where private operations are permitted. Venezuela's daily production has tripled in increasing nearly 1 million barrels since 1937. Production in 1937 averaged 510,000 barrels daily and 1,492,000 barrels in 1950. The amount of increase alone is five times the 200,000 barrels produced daily in Mexico during 1950. Arabia, which had just received its first oil producer in 1937, produced 547,000 barrels last year, or more than 2½ times the output of Mexico. Kuwait, which was not productive in 1937, produced an average of 345,000 barrels daily last year. Iran, which in 1937 produced less than twice what Mexico did, produced more than three times as much in 1950. In the U. S., oil production increased almost 2 million barrels daily between 1937 and 1950. In contrast with these achievements, Mexico's 50 percent increase in production since 1937 is quite small.

Even with such a prolific source as Poza Rica merely requiring further development to assure greater producing ability, Mexico's rising domestic consumption of petroleum (102 gallons per capita in 1950, compared with 660 for the U. S.) has been met at the expense of a sizable reduction in the country's oil export balance—a sorely needed dollar earner for financing additional oil and other industrial development.

Mexico had a far larger export balance in oil during 1950 than in any year since World War II, but exports last year exceeded imports by less than 16 million barrels. This compared with net exports of more than 22 million barrels in 1937, the final year of private enterprise operation. It's true some of Mexico's imports, particularly gasoline and special products, result from an exchange agreement with U. S. refineries, but such an arrangement to export crude in return for refined imports is necessary due to insufficient refining facilities and transportation difficulties of Pemex.

Increasing domestic consumption poses a problem for Pemex. Last year Mexicans used 59,648,000 barrels of crude and products, up from an average of about 27 million barrels annually in the years immediately preceding World War II. The increase in 1950 over the previous year was smaller (4 percent) than usual and probably would have been larger if Pemex had facilities to supply the total Mexican market. The nation's consumption is expected to increase substantially in the immediate future if supply can meet anticipated demand. The previous drilling program of Pemex indicates Poza Rica's maximum production potential will be put to test during the next few years. Prudence and conservative practice would warrant handling Poza Rica with utmost care, since should the field be over-produced or mishandled, the Mexican petroleum supply would be curtailed seriously.

Pemex is completing large wells in a new southeast extension of the Poza Rica structure, known as Escolin, and the immediate need for additional production can be solved to some degree by further development of this area. Nevertheless, the discovery of new reserves in Mexico is a matter of extreme urgency if production is to continue to meet minimum domestic requirements. The small margin of excess production over domestic consumption presently would provide little material assistance to the nation's sister Western republics in an emergency. In the event of an early allout war, competent observers say Mexico's contribution of petroleum would not exceed 70,000 barrels a day—the equivalent of about one-fifth of the present military requirements of the United Nations forces in Korea. This, however, would be well above Mexico's negligible oil contribution to the Allies in the last war when the export balance ranged between 2,873,000 and 5,382,000 barrels (7,870 to 14,740 barrels daily) from 1942 through 1945.

Taking note of the Mexican petroleum supply and world conditions, Senator Antonio J. Bermudez, gen-

eral managing director, in announcing Pemex' 1951 development plans stated: "We must be increasingly cognizant of the extraordinary importance of the time factor, especially in these moments in which—in view of the uncertain conditions through which the world is passing—the aim of the President of the Republic is to reach the maximum development of the Mexican petroleum industry, with the object of being safe and able to defend ourselves from the consequences of a possible state of emergency."

Pemex embarked on a larger scale exploration campaign in 1948, stepped it up in 1949 and 1950, and programmed the largest drilling effort yet for 1951. The results of this intensified drive to discover new petroleum resources will determine the true success of the government monopoly operation. So far, however, the record of new discoveries by Pemex has been poor. In 13 years, through 1950, it made only 18 new discoveries of oil and gas, none of them important. Thus, a significant requirement of the petroleum industry that a continuous line of new discoveries is needed to maintain and increase the productive capacity of the raw material has not been followed. The poor record of discoveries results primarily from the unwillingness to risk capital except where the investment means assured additional oil production. The generally limited funds available makes wildcatting a luxury.

Lack of funds has been used by Pemex as a defense to criticism of its small wildcatting effort, but such a limitation is among the inherent weaknesses of the single company system of operation. Pemex had its biggest drilling year in 1950 with a total of 217 wells (886,008 feet) completed, of which 17—or 8 percent—were exploratory tests. In comparison, 18 percent of all the wells drilled in the U. S. last year were classed as "strict" wildcats and 22 percent of the Canadian well completions in 1950 were tests.

Drilling Program

Pemex' drilling program, rather than tied to exploration of the available new areas, is geared to meeting a quota of new production. For 1951 the monopoly's stated purpose is to increase output by 80,000 barrels over the daily average of 197,170 barrels produced in 1950. This would be nearly twice the increase realized in 1950 over the previous year. Under such a method of planning, wildcatting is minimized in favor of increased production from old areas—the easiest way to meet the quota. Even the projected increase in drilling by Pemex this year will not result in a campaign of the proportion considered necessary (estimated at a rate of 1000 new wells annually by foreign observers) to develop properly Mexico's oil.

In evaluating the 13-year record of Pemex' operations, the first eight years from the time of expropriation through the end of World War II resulted in little progress. It was a period marked by indecision and technological ignorance. Production rose slowly, reaching 43,547,000 barrels in 1945—3,360,000 barrels less than was produced in 1937. Pemex drilled 258 wells between 1938 and 1945, including 45 at Poza Rica and 20 wildcats. Of the latter, only the Mision gas field was discovered in 1945, eight years after Pemex began operations.

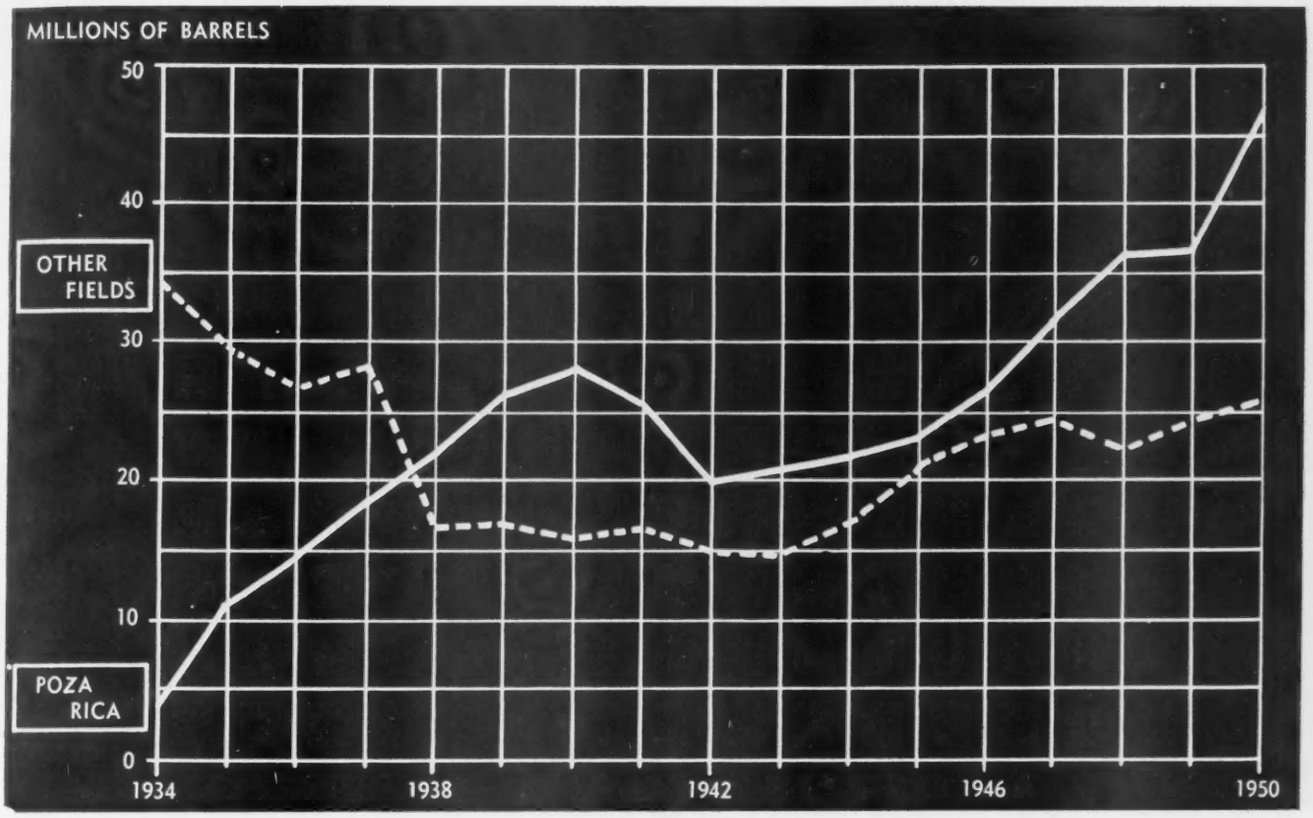
Private companies in the five years immediately preceding expropriation drilled 440 wells, or 70 percent more than Pemex drilled in its first eight years. The half decade before 1938, it is to be noted, was one of generally reduced activity by the foreign companies facing an uncertain future in Mexico. Prior to the expropriation decree of March 18, 1938, there had been a steady encroachment by the government on oil concessionaires dating back to the Petroleum Law of 1925 and the Constitution of 1917.

Pemex entered its most progressive period following the termination of the war in 1945. Some easing in the tight steel situation was a factor, but the most important development was a change in the administrator of the government monopoly. One of the first moves of President Miguel Aleman when he took office in 1946 was the appointment of Senator Bermudez to head Petroleos Mexicanos. Senator Bermudez, a wealthy industrialist, is not a professional oil man, but he is recognized as one of the most competent administrators ever to accept

Statistical Summary of Mexico's Petroleum Industry

YEAR	CRUDE PRODUCTION*			WELLS COMPLETED				DEMAND and FOREIGN TRADE TRENDS			
	Total	Poza Rica	Other Fields	Total	Oil	Gas	Dry	Domestic Consumption	Exports	Imports	Export Balance
Pre-Expropriation:											
1933	34,001	.....	34,001	96	53	1	42	.....	19,717	1,453	18,264
1934	38,172	3,772	34,450	148	54	1	93	.....	22,694	1,488	21,206
1935	40,241	10,940	29,751	78	37	1	40	.....	20,573	1,484	19,089
1936	41,028	14,220	26,808	61	28	2	31	.....	23,215	1,503	21,712
1937	46,907	18,620	28,286	57	23	3	31	24,122	24,560	2,348	22,212
Expropriation:											
1938	38,506	22,000	16,506	34	12	2	20	24,006	8,564	1,670	6,894
1939	42,898	26,300	16,598	25	15	0	10	26,095	16,358	1,382	14,976
1940	44,036	28,350	15,686	44	16	3	25	27,113	18,733	2,162	16,571
1941	42,196	25,800	16,396	29	12	1	15	28,129	13,744	2,148	11,596
1942	34,815	19,850	14,965	18	4	2	12	30,123	6,303	1,572	4,731
1943	35,163	20,540	14,623	16	7	0	9	33,197	5,764	1,856	3,908
1944	38,302	21,460	16,743	33	20	0	13	34,987	4,933	2,060	2,873
1945	43,547	22,949	20,598	59	28	3	28	35,495	7,911	2,429	5,382
Post-War:											
1946	49,235	26,213	23,022	49	25	2	22	39,664	9,406	3,380	6,026
1947	56,284	31,951	24,333	50	23	2	25	41,623	14,508	4,641	9,867
1948	58,508	36,500	22,008	80	40	3	37	46,272	12,097	4,685	7,412
1949	60,910	36,660	24,250	158	82	14	62	56,620	13,581	5,578	8,003
1950	72,117	46,716	25,401	217	110	47	90	59,648	23,308	7,450	15,858
Future:											
1951	.....	.....	.....	..	..	..	..	63,675†	.....	.....	.....
1952	.....	.....	.....	..	..	..	..	68,068†	.....	.....	.....
1953	.....	.....	.....	..	..	..	..	72,872†	.....	.....	.....
1954	.....	.....	.....	..	..	..	..	78,132†	.....	.....	.....
1955	.....	.....	.....	..	..	..	..	83,900†	.....	.....	.....
1956	.....	.....	.....	..	..	..	..	90,238†	.....	.....	.....

† Thousands of barrels annually.



This chart shows how essential to Mexico's petroleum industry is the fabulous Poza Rica field, discovered under Free Enterprise. The field's production surpassed all others combined in 1938, the year of expropriation, and has since carried the major burden of Mexico's total output.

an important position in the Mexican government. The degree of progress made by Pemex in the postwar years can be attributed directly to the businesslike manner in which the senator has conducted the company. Unfortunately for the future of the Mexican industry, Pemex' director could change with the next administration.

Activity has increased under the senator's direction and in the last five years 554 wells have been drilled, or nearly 70 percent of the total of 812 wells completed since expropriation. Of all these completions, 443 resulted in oil or gas wells, a ratio of 55 percent. Considering the comparatively small number of wildcats drilled, this is a particularly good showing.

With the greater development by Pemex in the past five years, production has been increased 65 percent to 72,117,000 barrels and proven reserves have risen 37 percent to 1.3 billion barrels. Canadian production in the same period jumped 285 percent to 29,259,000 barrels daily despite strict proration due to lack of a pipe line outlet from the Prairie Provinces, and reserves have bounded up more than 1500 percent to 1.2 billion barrels. It might be noted that while Canada is an older producing nation than Mexico, private capital did not take serious interest in the development of production in Western Canada until after the war. Before 1941 the big interest in exploration and exploitation had been in Mexico and South America. Expropriations and tighter restrictions on foreign companies were indirectly responsible for the shift to Canada.

The financial success of Pemex' operations are even more dubious than the operating results. According to press releases its operations are entirely "self-financed" and Pemex can cite a record of "taxes and other payments" made in each year to the Mexican government. It will not state, however, what funds it receives from the public treasury. Pemex reported its income from sales in 1950 at $187,550,000. It paid the Mexican government $49,760,000 and presumably operating expenses took a further bite of gross revenues.

Regardless of what the financial and operating results have been, it is noteworthy that Pemex has not reached its present position without the aid of private American capital. In the past three years a half dozen American firms have been enticed to Mexico to participate in developing the petroleum industry as percentage of production contractors to Pemex. The working agreements generally pay the contractors 15 to 18 percent of the oil they find and produce for a maximum of 25 years with an additional reward up to 50 percent of production until drilling costs are repaid. No payments are made, however, unless oil is found. Pemex signed a contract with Cities Service Company in 1948 whereby the latter agreed to make available a loan of $10 million for exploration and development by Pemex of areas which had been claimed by Cities Service as its valid concessions. Later in the same year negotiations for a development loan of $30 million from The Texas Company were unsuccessful.

An unsuccessful attempt was made to arrange a much larger petroleum development loan from the Export-Import Bank in 1949 and last year an oil loan from the U. S. government was discussed but did not materialize. The Mexican government later in 1950 did receive a loan from the U. S. of $150 million to finance construction and improvement of its railroad and highways, aid agriculture, irrigation and electric power and telecommunications—all projects of the Mexican government.

Devon Holds An Oil Show.

KINGDOMS OF OIL

No. 6

DEVON, ALBERTA

Canada's Model Boom Town

By BOB SHIELS

Oil Editor

Edmonton *Journal*

DEVON, Alberta, Canada's "model boom town" whose birth less than four years ago was precipitated by the discovery of the vast Leduc-Woodbend oil field, observed its progress in partnership with oil last month with a three-day, $1 million petroleum exhibit that drew hundreds of visitors.

Devon, 26 miles southwest of Edmonton, is a town of 1200 population in the heart of the oil field. Its surrounding wheat fields are dotted with derricks, monuments to the unending search for the Devonian-age crude which lies in great pools at 5000 feet and deeper. At night, the sky around Devon is brightened by the reflected flames of countless burning sump-pits and flares.

The story of Devon began February 13, 1947, when Imperial Oil, Limited, Canada's No. 1 petroleum corporation, brought in a discovery west of Leduc, a small town 20 miles south of Edmonton and about ten miles southeast of Devon. The Leduc-Woodbend field, with reserves now estimated at 250 million barrels of crude, grew rapidly.

THE STORY of Devon, Alberta, began February 13, 1947. It has not been completed yet; however, its progress has already gained it the title of Canada's "model boom town." Born to care for the needs of thousands of oil workers who swarmed in after the discovery of the vast Leduc oil field, the planned community has stood the test of four years.

As thousands of oil workers swarmed into the Edmonton-Leduc area, the need for adequate housing facilities became acute. Imperial Oil, in cooperation with the provincial government, conceived the first plans for a model oil town. The plans were drafted by the Alberta Town Planning Commission and the first housing units were financed with the aid of Central Mortgage and Housing Corporation, a federal government agency. The new town was named after the oil-producing Devonian formation.

From its beginning, Devon has been

a totally-planned community. Each of its wide, boulevarded streets is named after a lake; its avenues bear the names of Canadian rivers.

Citizens of Devon object strenuously to any suggestion that theirs is a "company town." Since it was built by Imperial in conjunction with government housing authorities, Devon's administration has come almost entirely into the hands of its residents. The company now has jurisdiction over only its Devon field offices and a few bungalow-like "baches" which house unmarried personnel.

Devon has a complete water system, the supply for which is obtained from the nearby North Saskatchewan River and pumped 300 feet up the river bank to the townsite. Fuel is supplied from Imperial Oil's $5 million gasoline plant, built just outside the town limits to provide an outlet for natural gas which is produced incidentally along with oil from the Leduc field.

Main street at Devon. Part of a drilling rig is being moved through the town, en route from a Leduc-Woodbend well to a wildcat north of Edmonton.

Wells In Town

The visitor to Devon approaches the town along one of three graveled highways, newly-built through the oil field. Above the wheat fields, he sees black smoke clouds rising from innumerable well sites. He finds three producing oil wells within the town itself.

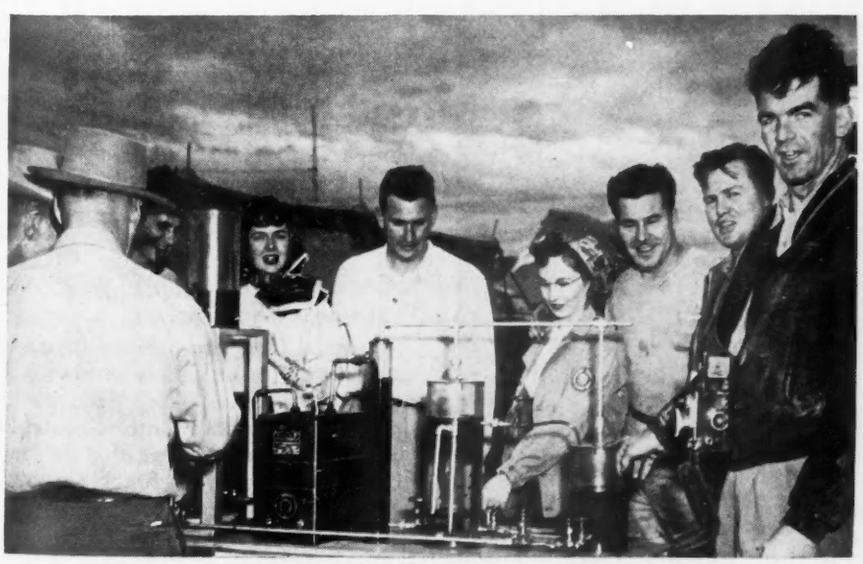
Devon is a young man's community. Almost the full population is made up of Imperial Oil employes. The average age of the townsmen is about 30, and it is estimated there are only about a dozen "old-timers" of the 50-to-60-year age bracket.

Devon also is a "family" community. Only about 100 of its residents occupy Imperial's bachelor headquarters. A spirit of frontier friendliness and small town neighborliness dictates that nearly all social functions be community events.

"We have a fine community here—the best in Canada," 29-year-old Herb Speed, Boy Scout leader and construction worker for Imperial says. "I've lived in small towns all my life, and I don't know of any better place. The cost of living is a little high, but it's a wonderful place to raise children. There are good schools and good playgrounds. And juvenile delinquency is never even thought of in Devon; the boys and girls are all too busy."

The youthful, optimistic scout leader, typical of all Devonians, lives in a five-room modern home for which he is paying $4200 by monthly installments of $39. In his basement he has a two-room suite which he rents for $45. "So actually my home isn't costing me anything."

The inexpensive housing units provided at Devon have enabled many oil workers to establish homes of their own. Many drillers and roughnecks had been accustomed to moving about the country from well to well, living in tents and trailers. One such worker, now living in a prefabricated Devon house, said his children hadn't seen a real bath tub in ten years before the town was established.



An interested group at the oil show.

Community Projects

Devonians are enterprising workers. To provide themselves with recreational facilities, they have put their voluntary efforts behind construction of a community hall in which dances are held, a swimming pool, skating rink and curling rink, picnic grounds and a baseball park. Under construction this year is a nine-hole golf course on the banks of the North Saskatchewan River. In this project, as in most others, the work is being done by townsmen themselves.

Growing with the boom town is a

thriving business district. Commercial centers include a modern hotel, coffee shop, "Club Pagoda" dine and dance hall, a hardware store, drug store, telephone office, lumber yard, grocery, clothing store, meat market, billiard hall, garage, library, theater, men's wear store, electric shop, bank, bakery, jewelry, shoe repair shop, doctor's office and barber shop.

In three years, Devon has attained a stature usually reached after at least 30 years of continued community growth. A hamlet until January 23, 1949, Devon became a village and elected three village councillors at that time. When Devon became a town in March, 1949, George H. Thompson, a robust, optimistic citizen not yet 50 years of age, was elected the first mayor by acclamation.

"By this time in 1952, Devon will be double its present size," the mayor predicted recently. "The town now occupies two quarter sections. We hope shortly to incorporate three more quarters.

"The finest people in the world live at Devon," the mayor said, "and if you don't believe it, come on down and meet them in their homes. There is a fine spirit of community enterprise. We all get out and work here at Devon."

This spirit of irrepressible faith in the future can be found in nearly every Devonian.

"We've all worked hard and we've made a wonderful town," says Mrs. Bruce Eaton, who was among the original settlers at Devon. "There's always lots of activity around here; it's never a dull place. I've always lived in the city and I never thought I would like a small town, but I sure do like Devon."

A Merry Christmas

Christmas, 1949, was a memorable occasion at Canada's model oil town. Imperial-Leduc No. 63 had found D3 Devonian oil and was swabbed into production on December 27. The derrick was covered with colored Christmas lights and Devonians boasted one of the largest Christmas trees in the country.

A wild oil well had much to do with focusing attention on the model town. Atlantic 3 was probably Canada's most publicized wild well. Located two miles southeast of Devon, the well blew wild in March, 1948, raged out of control for six months, then caught fire September 6. Newspaper headlines recorded the fight to tame the blazing "gusher" until it finally was brought under control with the aid of two directionally-drilled wells.

Providing public and high school facilities for young Devonians was a major problem in the early days of the town's history. Forty-two pupils attended the first class held in the basement of the teacher's home on September 20, 1948. Since that time, a four-room public school and five-room high school have been built. The principal of both institutions is 25-year-old Murray Smith.

Regular church services are held in a new United Church of Canada building. A student minister of the United Church is stationed at Devon. Other denominations hold Sunday services, conducted by out-of-town ministers, in the town's community hall. The Roman Catholic Church hopes to erect a building at Devon in the near future.

Imperial Oil's fire-fighting facilities stand ready for service. The town has its own one-man police department, headed by youthful Chief Constable John Stark. In the year that he has held office at Devon, Stark has had little call for his services.

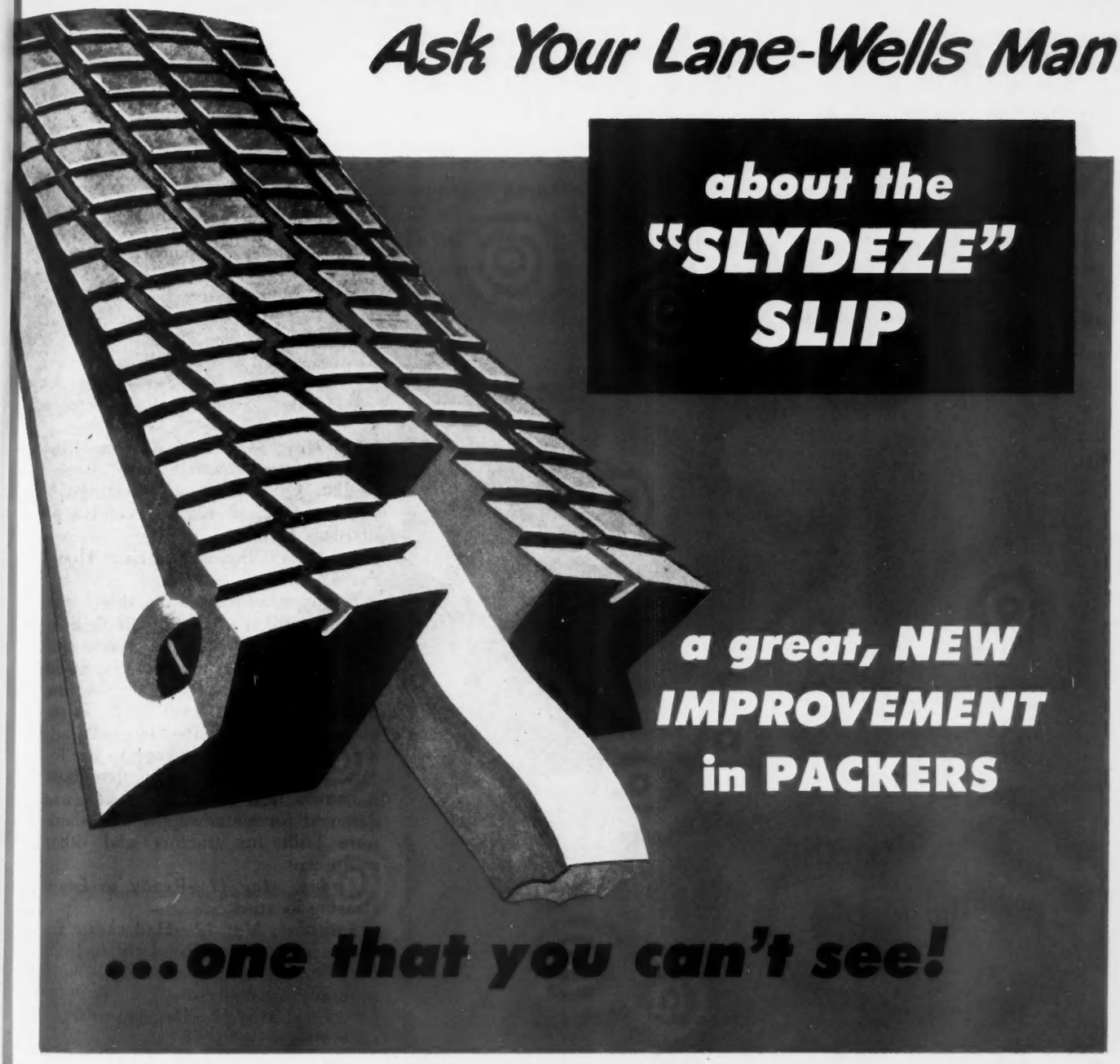
"It's a law-abiding community," he said recently. "There hasn't been a major crime committed here yet."

In the absence of major crimes, Chief Constable John Stark has plenty of time to keep his eye on speeders.

About the Author

BOB SHIELS, Edmonton *Journal* oil editor, is a native of Medicine Hat, Alberta's fourth largest city, and situated in the center of the Medicine Hat natural gas field, one of the largest on the continent. He was general assignments reporter for the Medicine Hat *News* for two years, during which time he became familiar with gas production. For the past two years, he has been on the staff of the *Journal*.

Ask Your Lane-Wells Man



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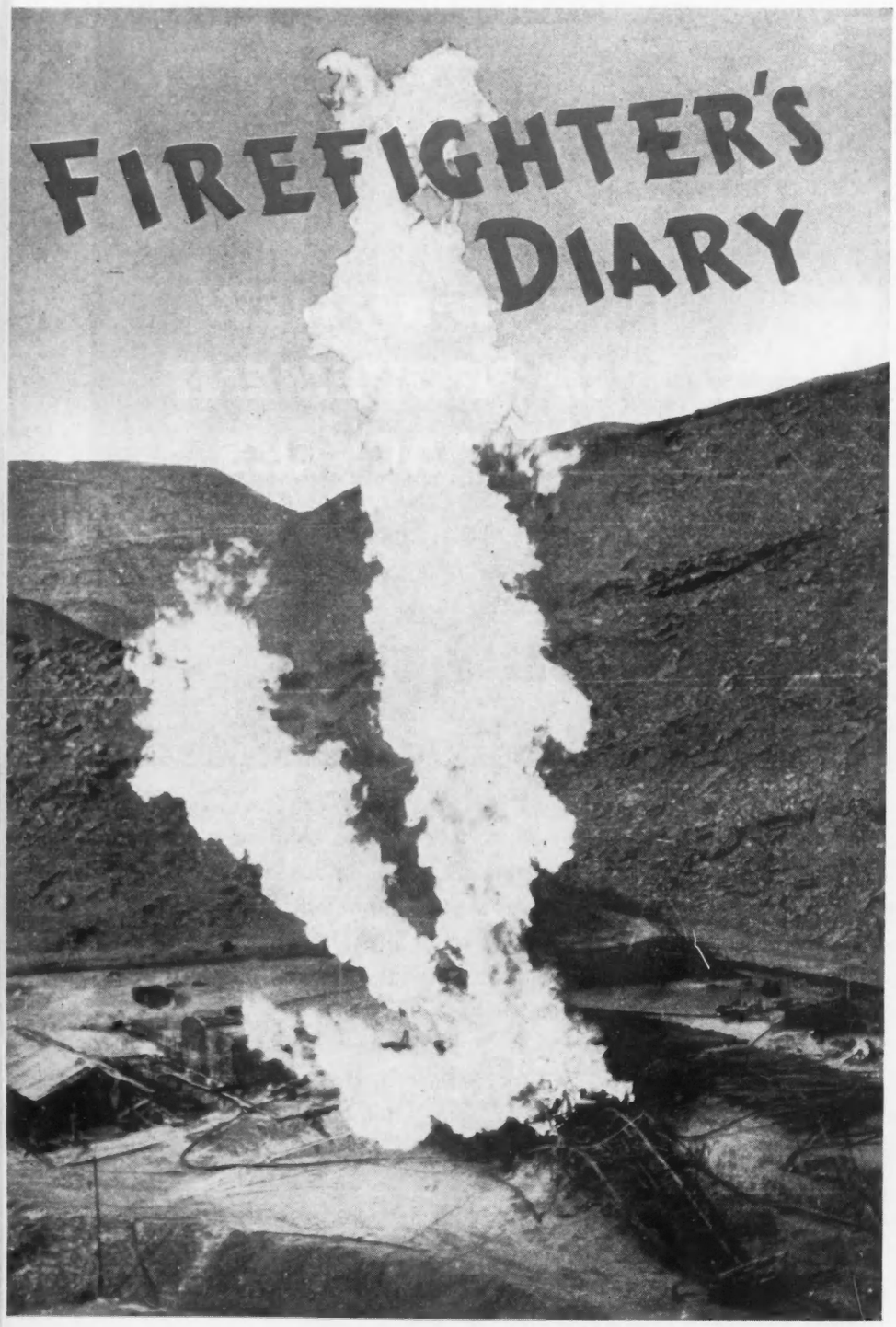
EDITOR'S NOTE: *Between the time Myron M. Kinley stepped into an airplane at Houston's Municipal Airport May 1 and returned 15,000 miles and nearly two months later, the intrepid, internationally-known oil and gas well firefighter had extinguished the worst fire he has faced in a quarter century of pitting courage and ability against wells aflame. The well, which caught fire May 1, was 125 miles north of Abadan, Iran, in Anglo-Iranian Oil Company's Naft Safid field. Kinley expressed appreciation for the cooperation he received from AIOC officials and personnel. After the well was capped, AIOC presented Kinley with a 1788 silver platter for his successful efforts in stemming the blaze, the company's first in 40 years. Kinley kept a diary of his activities which, because of its unusual subject, is herewith presented.*

FIREFIGHTER'S DIARY

By MYRON M. KINLEY
M. M. Kinley Company, Houston



Vertical flame is blowing through the overshot. Flame at 45-degree angle is from bonnet of a four-inch sideline valve. Horizontal flame is blowing from two-inch pipe on top of the cellar wall.

Tuesday, May 1, 1:30 p.m.—Received urgent request from Anglo-Iranian Oil Company to extinguish burning gas well 125 miles north of Abadan, Iran.

3:30 p.m.—Boarded plane at Houston. Destination: Abadan.

Friday, May 4, 12 noon—Flew over burning well, then on to air field at Abadan. Eleven miles of 8-inch and 11 miles of 6-inch pipe line were laid for water supply at location. This line was completed in seven days—a remarkable feat. A four-mile road leading over a mountain range to the location was constructed in five days. A canyon near the well location was dammed for water supply and sheds were built for tractors and other equipment.

Friday, May 11—Ready to begin clearing location.

Saturday, May 12—Had casing removed and saw wellhead connections for the first time. Fire was leaking around some flanges.

Sunday, May 13—Decided to shoot off connections.

Wednesday, May 16—Shot off connections, and had the fire going straight into the air. A 2500-foot string of drill pipe shot straight up. Changed working site because of the intense heat. Decided to come in from a different direction.

Monday, May 21—Began laying four-inch line into the location for water source at the well.

Tuesday, May 22—Began working from new location.

Wednesday, May 23—Checked connections, decided I needed different equipment and connections to put on top. Contacted London (AIOC headquarters), described needs, and London wired Houston for special flange and spool. Also contacted London for a valve, and AIOC found a 12-inch hydraulically-operated valve in London, which a chartered plane brought to location. Weighing over four tons, it was a plane load.

Started cleaning out cellar and

made preparations to shoot the well out.

Sunday, May 27—Shot the fire out with 500 pounds of 60 percent gelatin, and started to clean out sub-cellar.

Monday, May 28—Moved in draglines and began digging on cellar.

Wednesday, June 6—Cellar cleaned out and pipe showing enough to take off Bradenhead connections.

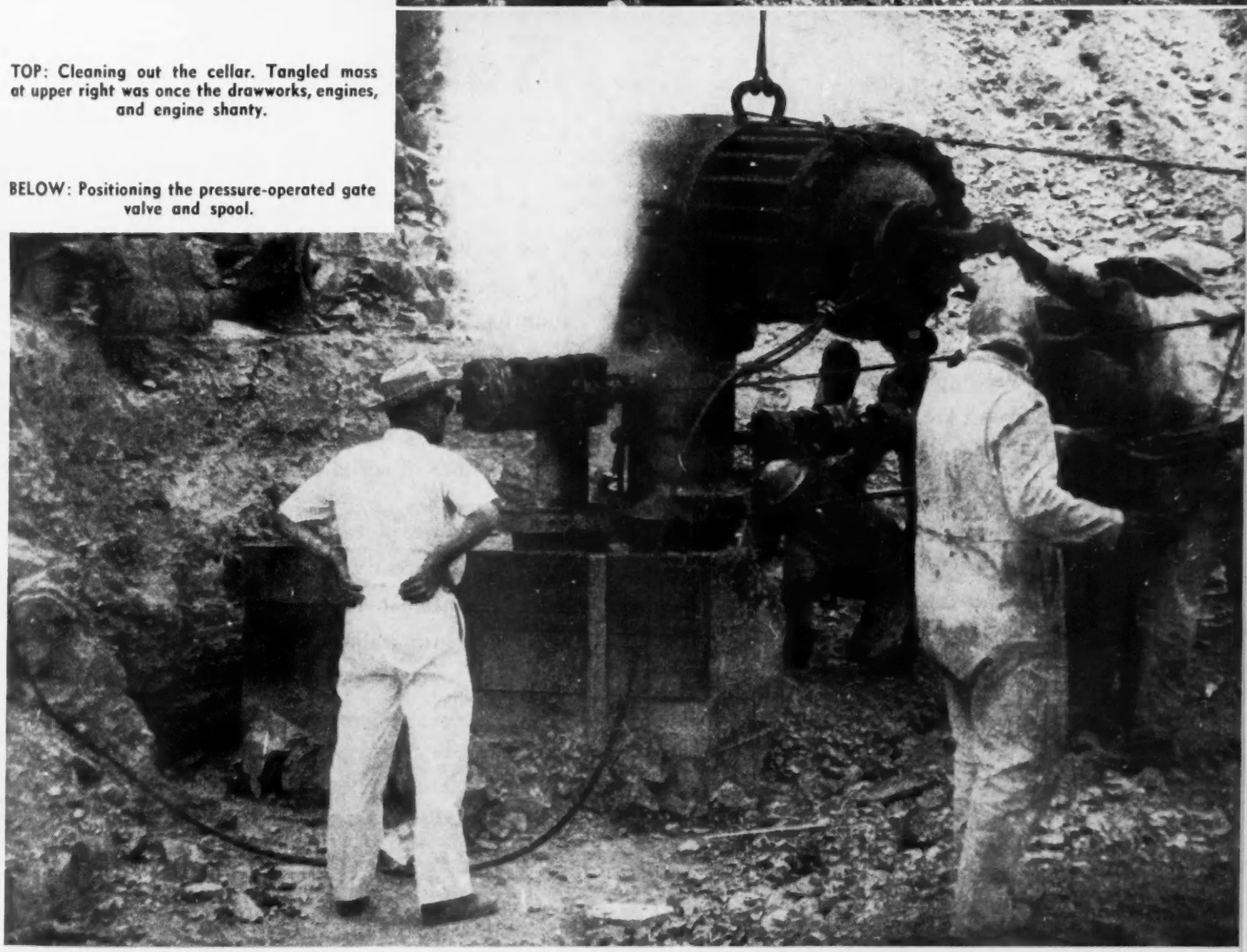
Thursday, June 7—Took off Bradenhead connections. The 16-, 13-, and 11-inch casing had to be stripped over the 8⅝-inch casing.

Friday, June 8, and Saturday, June 9—Rigged up connections.

Sunday, June 10—Placed slip-type flange over 8⅝-inch casing, and poured concrete foundation block around it.

Monday, June 11—Installed pressure-operated valve, and connected up four-inch bleedline, and closed well in about 7 p.m. Very nearly had a serious accident: The thrust on the four-inch line was so great that it started to unscrew valve, but the stock caught it and saved any possible injury.

TOP: Cleaning out the cellar. Tangled mass at upper right was once the drawworks, engines, and engine shanty.



BELOW: Positioning the pressure-operated gate valve and spool.

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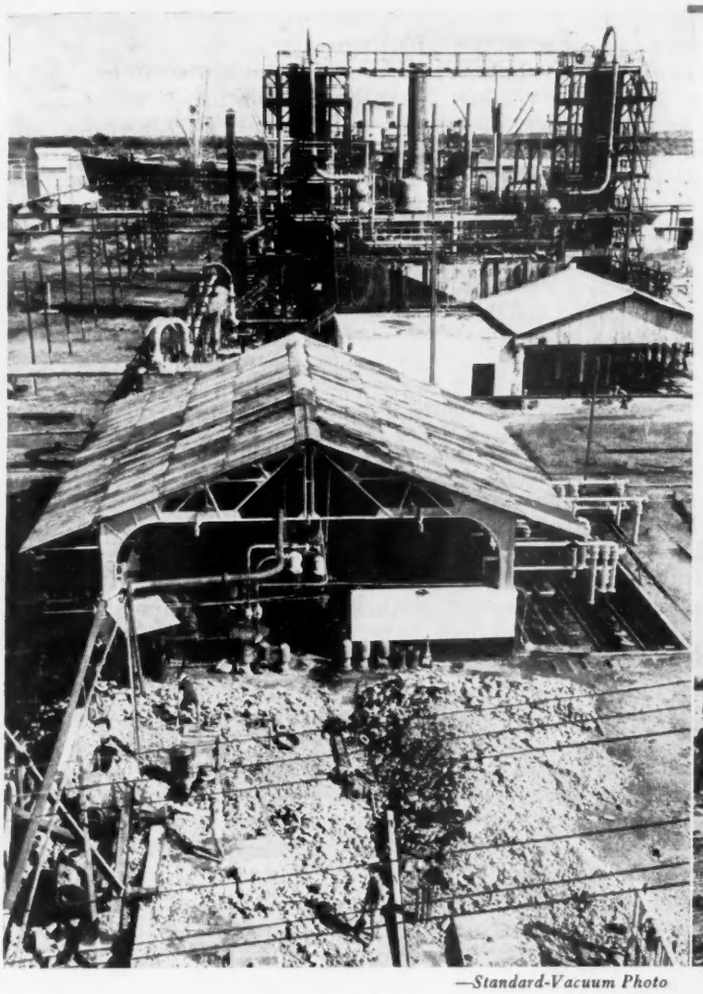


—Standard-Vacuum Photo

—Standard Oil Company of California Photo

LEFT: Repairing war damage done to a pump house on the Sueri Gerong, Sumatra refinery of Standard-Vacuum Petroleum Mij. Despite extensive destruction by both Japanese invaders and retraining employes early in the war, and later by Allied bombers attacking Jap occupation forces, this plant has been rehabilitated and operations are near capacity.

RIGHT: Minas 1, discovery well in the Minas oil field in Central Sumatra, where N. V. Caltex Pacific Petroleum Mij. plans extensive development. A 12-inch pipe line outlet from this field is being completed for operation early in 1952.

WITH oil production from the fields of Sumatra, Java, and Borneo (not to be confused with British North Borneo) expected to reach a new high in 1952 when new transportation facilities are completed from a major supply source, the petroleum industry of the young Republic of Indonesia has achieved a near miracle of rapid rebirth, despite the crippling effects of postwar revolution and extreme internal disorder.

This accelerated recovery, arising out of the ashes of almost total wartime destruction inflicted by retreating Dutch forces under the scorched-earth policy and by the invading Japanese, has regained for the nation its position as the largest producer in the Far East—an area that holds much promise as a future major source of oil for Oceania and parts of the Eastern Hemisphere.

Indonesia's crude production bounded up sharply to 50,300,000 barrels in 1950—more than 23 times the low reached in 1946. While this is less than the 1939 peak output of 62,087,000 barrels, it is equal to the yearly average of the decade immediately prior to the start of hostilities in the Pacific.

The postwar rehabilitation of properties by the two major concessionaires—N. V. Bataafsche Petroleum Maatschappij (Shell Group) and Standard-Vacuum Petroleum Maatschappij [Standard Oil Company (N. J.) and Socony-Vacuum Oil Company]—came during Indonesia's most serious period of political unrest. For the immediate future the outlook is more promising, though there are no guarantees of complete stability.

The present cabinet of 20 ministers, a coalition of seven parties, most of which are politically left of center, took office April 27 following a 37-day crisis created by the resignation of the previous government. Its tenure of office depends entirely upon the ability to satisfy a nation where the seeds of nationalism have been heavily sown. The political and economic thinking of a large majority of the population has tended towards economic, as well as political, independence from foreigners. In its years as a colonial possession, the former Netherlands East Indies had no industry; its purpose in the economic orbit of colonialism was to provide such raw materials as rubber, copra, coffee, and petroleum to foreign owners.

While the intense nationalists desire to reverse such a system, responsible cabinet officials have preached and,

so far, practiced a more moderate and realistic philosophy. The most important pronouncement of top official thinking was contained in a statement of policy early in June by the new premier, Dr. Sukiman Wirjasandjojo, a member of the Masjumi (Moslem) Party. As quoted by the Aneta News Service from Djakarta, Dr. Sukiman said: "In building up the national prosperity we should never lose sight of the way the economic structure of our country is constituted at present. In other words, we must realize fully the part played by foreign capital and manpower in our economy." Whether such policies can contain impatient nationalists is unpredictable.

Moves towards nationalization of certain basic parts of the economy are being initiated by the government. So far there has been no specific request to nationalize oil; there does exist, however, a desire for the nation to receive greater benefits from its productive ability. To this end, legislation currently is being blueprinted in Parliament demanding the government be given a substantially larger share of petroleum profits. Recognizing the importance of oil to the nation (petroleum shipments last year accounted for 20 percent of Indonesia's total exports) Teuku Hassen, sponsor of the proposed bill and former governor of North Sumatra Province, said royalties must be doubled or tripled if the government is to get a "just" share of its petroleum wealth.

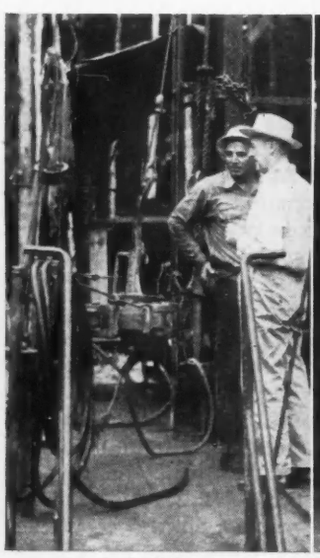
His views were summarized in press dispatches as: "The foreigners must be allowed a fair profit for their services and technical know-how. We don't want them to quit, but if they do, we won't shed any tears. We are perfectly able to run things ourselves." This last reference is to the Pankalan Brandon fields of Atjeh, North Sumatra, owned by Indonesia's biggest oil producer, Shell's BPM. Installations there, destroyed during the war, were rehabilitated by Indonesian nationalists with materials available, and this group has managed production in the area in the past 4½ years.

Contracts 'Unsatisfactory'

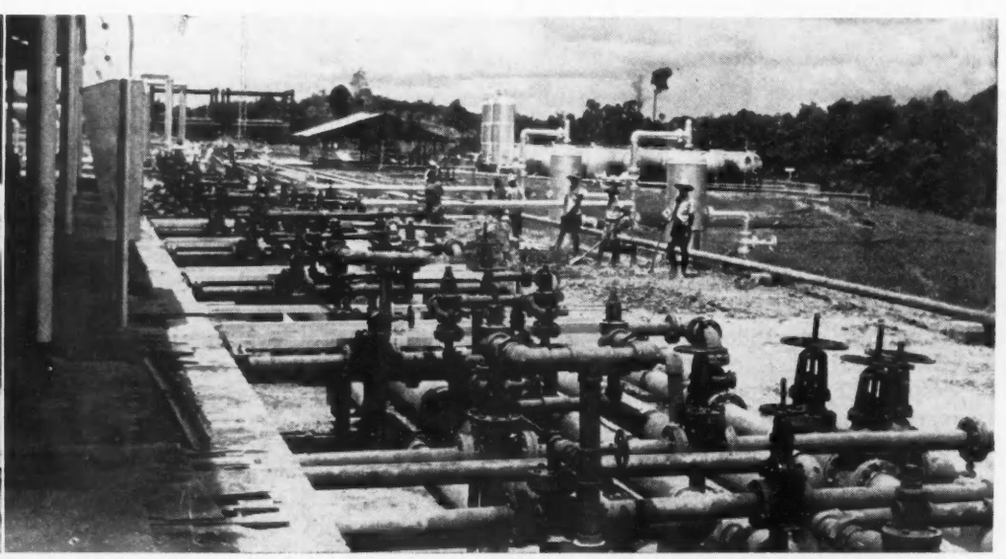
In the background the nationalists are further stirred by contracts completed just before the transfer of sovereignty from the Dutch rulers was accomplished in December, 1949. These permit BPM and Standard-Vacuum to keep most of their earnings from sale of Indonesian oil in foreign currencies. This allows flexibility in purchases of necessary materials and has been an important factor in the fast rehabilitation of producing properties. Premier Sukiman himself termed these pre-independence monetary agreements "highly unsatisfactory" in that Indonesia's foreign exchange position is not benefited. He added: "But on the other hand these agreements are not so harmful as some members of Parliament assert."

Aside from present basic industries, the new government's directives require it to have a predominant influence in new enterprises (foreign and domestic) occupying key positions in the country's economy. This influence is spelled out as at least 50 percent participation in the capital by the government and control of more than half the seats on the boards of directors of such entities. Other less important foreign enterprises must have a majority of their stock owned by Indonesians, with corresponding control of directors.

While the Shell Group company and Standard-Vacuum are the only oil producers at present in Indonesia, a third prewar concessionaire—N. V. Caltex Pacific Petroleum Maatschappij, jointly owned by Standard Oil Company of California and The Texas Company—anticipates commencement of production after completion in the second quarter of 1952 of a pipe line from its Minas field of Central Sumatra. This field was discovered in February, 1950, after Caltex's re-entry into Sumatra in late 1949. Internal conditions prevented an earlier operation of its properties. Caltex has planned expenditures of $20 million this year in development of production and so far has completed four producers in the Minas field, bringing the total closed-in wells to 14, each with a producing potential of 1000 barrels of 36-gravity oil daily. The company also has closed-in production in the Duri and Sebanga fields of Central Sumatra, pre-war discoveries. The pipe line outlet will be a 20-mile, 12-inch carrier from the producing area to a projected terminal on the Siak River. Shallow draft vessels will move the oil from there for transfer to ocean-going tankers.



Standard Oil Company of California Photo

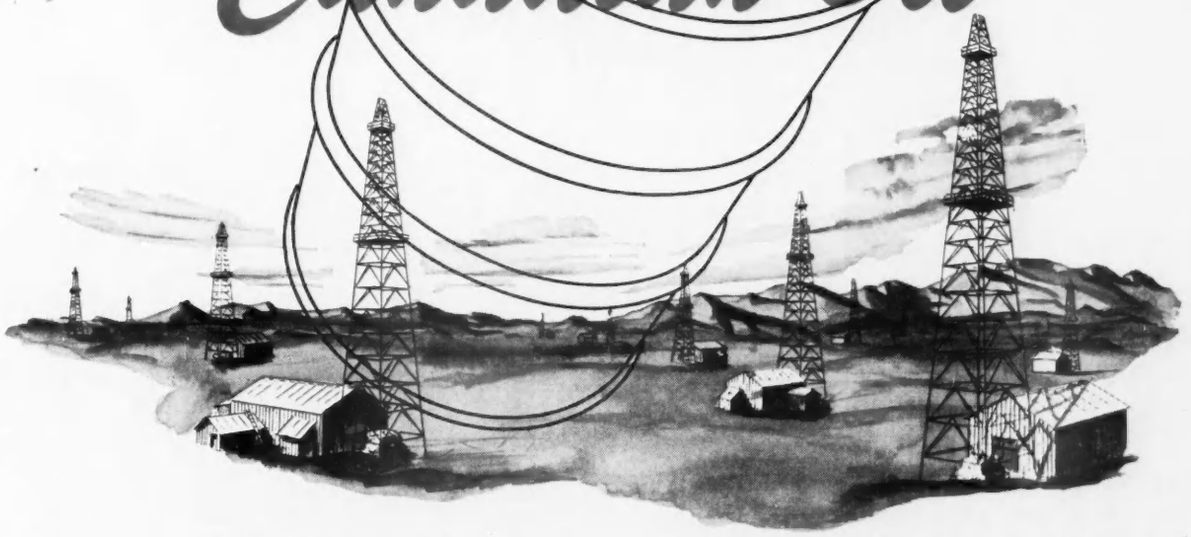


Standard-Vacuum Photo

LEFT: R. G. Follis, above right, on the floor of a rig in Central Sumatra's Minas field, said on his return from a recent trip to the Middle and Far East that the indicated petroleum reserves establish Sumatra as a "major future source of supply" for Southeast Asia and the South Pacific.

RIGHT: The manifold of the Pendopo gathering plant at the start of the 80-mile pipe line to the Sugei Gerong, Sumatra, refinery of Standard Vacuum Petroleum, Mij., near Palembang.

FACTS ON THE *Barrelhead* ABOUT *Canadian Oil*



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While the Bank is prepared to provide all available information on the oil industry, it does not make recommendations in regard to the purchase of individual oil stocks.

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Of World Oil Men

BURT E. HULL, vice president of The Texas Company and former president of Trans-Arabian Pipe Line Company, has retired after 46 years in the oil business.

Hull was first employed by The Texas Company in 1905 as a junior engineer and draftsman. Among his more recent engineering achievements was the 1068-mile TAPline from the oil fields of Saudi Arabia to Sidon, Lebanon, on the Mediterranean coast. During World War II he was vice president and general manager of War Emergency Pipe Lines, Inc., which constructed the Big Inch and Little Inch pipe lines from Texas to the East Coast.

Burt E. Hull

Hull was born in Navasota, Texas, and in the fall of 1901, when he was 17, went to Bryan, Texas, where he enrolled at Texas A. & M. College. Three years later he received his engineering degree. His first job out of college was that of junior engineer for Southern Pacific Railroad.

Hull's Texaco service—he was the oldest employe in point of service at the time of his retirement—began in 1905 in Beaumont. In 1907 he went to Dallas, thence to Texaco's West Tulsa Works, and then to Port Arthur Works. Two years later he was appointed chief engineer of the Refining department, with headquarters in Houston.

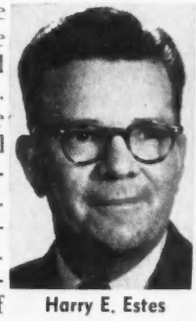
In 1922 Hull went to Tampico as vice president and general manager of The Texas Company of Mexico. Returning to Houston four years later, he was elected president and manager of The Texas Pipe Line Company. He also became president and manager of the Texas-Empire Pipe Line Company, the Kaw Pipe Line Company, and the Texas-New Mexico Pipe Line Company.

Hull plans to make his home in or near Dallas.

ELMER PATMAN of Austin, attorney for The Superior Oil Company, Houston, returned last month from the Third World Petroleum Congress, where he served as special representative of the Select Committees on Small Business, U. S. Senate and House of Representatives.

Accompanied on the two-month tour by his wife and son, Philip, he traveled and studied in England, Holland, Denmark, Sweden, Germany, Switzerland, and France.

HARRY E. ESTES, sales coordinator of the A-1 Bit & Tool Company, Inc., Houston, has been elected executive secretary of the Nomads National Board of Regents. Estes received the unanimous approval of the board to succeed Harold M. Cosgrove, who is retiring due to illness. Estes has been executive secretary of the Houston Chapter of Nomads for eight years, and will continue in that capacity also.



Harry E. Estes

C. A. P. SOUTHWELL, managing director of Kuwait Oil Company, Ltd., and formely manager of the Fields and Geological Branch of Anglo-Iranian Oil Company, has been reelected president of the Institute of Petroleum, London, England, for 1951-52. Southwell joined the institute in 1928, was elected to the council in 1936, made a vice president in 1948, and has been a member of various council committees.

At the same time Dr. E. B. Evans was elected a vice president. Dr. Evans, who is chief chemist of Esso Development Company, Ltd., was first elected to the council in 1939 and was vice president for 1948-50. He has been honorary associate editor and deputy chairman of the Publications Committee since 1946. He serves on several council committees, was chairman of the Standardization Sub-Committee 3 from 1943-48, and a member of and secretary of the Hydrocarbon Research Group from 1944 to 1947.

F. C. ZIMMER, connected with the drilling branch of the oil industry for the past 60 years, is re-

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tiring at the age of 72 from Trinidad Petroleum Development Company, Ltd., with which he has been associated 12 years.

Born May 1, 1879, Zimmer began his career on the rig floor at 13, near his home town of Petrolia, Ontario, Canada. His work took him to California in 1902 for the Associated Oil Company; to Borneo in 1904 for the Anglo-Saxon Company; back to the Ontario fields in 1906; to Peru in 1911 for the International Petroleum Company; to Canada in 1912; to Venezuela in 1920 for the British Controlled Oilfields, and later to the Caribbean until 1931, when he again returned to Canada. In 1939 he joined the Trinidad Petroleum Development Company, Ltd., at Palo Seco, Trinidad, British West Indies.

Zimmer will make his home in Petrolia.

"I'LL BE glad to get back to work in the tropics where it is cool!" So L. L. McWilliams, chief engineer, Socony-Vacuum Oil Company of Venezuela, Caracas, Venezuela, summed up his 10,000-mile vacation in the U. S. Mr. and Mrs. McWilliams and son, Gary, were resting on the eve of their return trip from Houston to Venezuela. Their visit to the U. S., which lasted from April 15, when they arrived at New York, to July 14, had been brimful of travel, relaxation, meeting new friends and renewing old acquaintances.

Anchoring vacation activities were business calls in New York; a visit with General Petroleum Corporation in California, a Socony subsidiary; a visit at Magnolia Petroleum Company's field research laboratory at Dallas and business and social visits in Houston, including a dinner with the Houston Chapter of Nomads.

As with many others, vacationing meant fishing to the McWilliams—fishing in Minnesota, where McWilliams netted a four-pound bass, his record catch.

SOCONY-VACUUM Oil Company has named Brandon H. Grove general manager of the company's operations in Egypt and the Red Sea to succeed Robert S. Stewart, who has retired.

The new appointment follows a 15-year period of service, mostly abroad. Grove joined Socony-Vacuum in 1935 and for the next four years was in the company's European offices. He returned to the U. S. in 1940 for a training period with Magnolia Petroleum Company, then was assigned to Spain and later Colombia. Grove was on loan to the Foreign Economic Administration from April, 1943, to July, 1946, and was in Europe again for Socony from 1946 to July, 1949, when he returned to the New York headquarters.

H. E. BRANDLI, formerly vice president and general manager, has been elected president of Cities Service Oil Company (Pennsylvania), succeeding Burl S. Watson, who recently was named chairman of the executive committee. Brandli has engaged in all phases of the company's widespread interests during the nearly 40 years he has been with the organization. In 1926, he became vice president and general manager of Cities Service Export Oil Company. In 1936, he was elected vice president of Cities Service Oil Company (Pennsylvania), retaining this position until 1946, when he became general manager.

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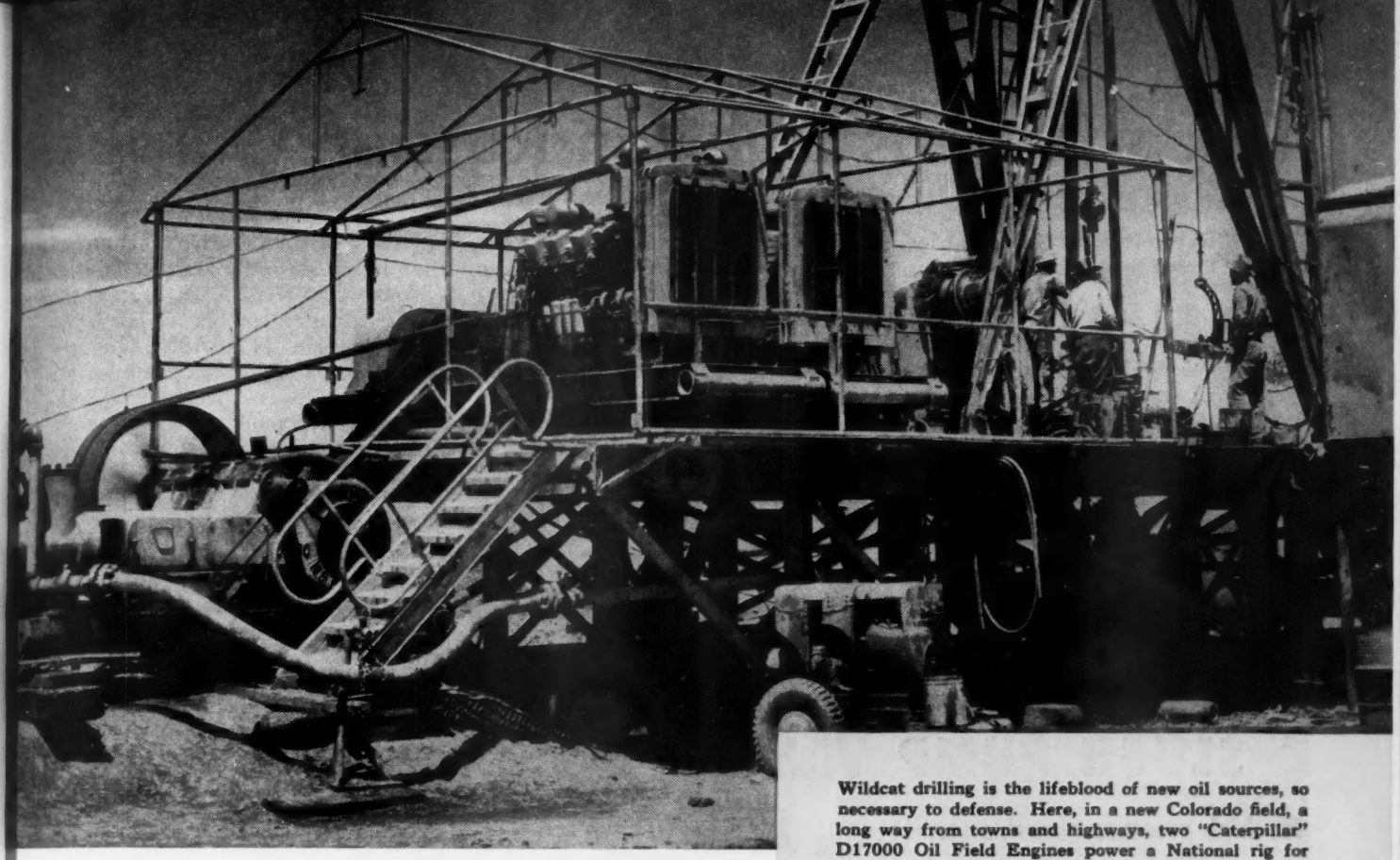

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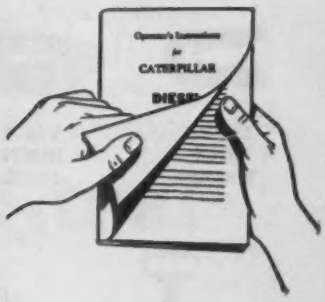

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Report Sheds Light on Russian Output

THE recent report of the Soviet Union to the United Nations Economic and Social Council on industrial achievements under the five-year plan which ended with 1950, while disguised in the usual "percentage of goal reached" method of Russian statistics, does shed some light on what 1950 crude production may have been when the claimed results are compared with latest known figures.

If the report of the Soviet State Planning Commission of the petroleum industry can be considered accurate, probably a dubious assumption even for USSR percentage of achievement figures, then previous estimate of Russian output for 1950 (including Sakhalin) at approximately 270,163,000 barrels, a daily average of 740,178 barrels, is comparatively close to that reported to the UN committee (WORLD OIL, Feb. 15, 1951).

The Russian report claimed the five-year plan (1946-1950) for the rehabilitation and development of the oil industry was "overfulfilled." In 1950, it was claimed, oil output comprised 107 percent of the five-year plan target and was 22 percent above prewar. Working from the basis of what are considered to be accurate prewar Russian production figures and the estimated target of the original five-year plan, it would be indicated that total Russian crude output in 1950 was approximately 273,465,000 barrels, or a daily average of 749,200 barrels. This is, of course, exclusive of oil available to Russia from its European satellite nations. This group in 1950 had total estimated production of 44,588,000 barrels, and presumably a large share of this went to the Soviet Union.

The report of the USSR petroleum industry was contained in a review entitled "Fulfillment of the Five-Year Plan in Industry." While at best a sketchy and probably far from complete summary, the report contains more information on Soviet oil plans than has previously been published by the communists. Reviewing the highlights of the five years of work, the report said:

The oil industry of Maikop and Grozny Districts and of Western Ukraine, destroyed during the war, was fully restored and re-equipped technically. (The latest geological data available list 15 fields in the Kuban-Maikop area, which lies just east of the Black Sea and on the western portion of the land corridor between the Black and Caspian seas. The producing horizons in the region are of Lower, Middle and Upper Miocene and Oligocene age, with productive depths ranging from 330 to 4920 feet. The Grozny area, also in European Russia, is just east of the Kuban-Maikop and borders on the Caspian Sea. Twelve fields are listed in this area, all producing from formations of Middle Miocene age. Three fields are listed in the Ukraine, the western border of which is on the northeastern Roumanian frontier, all of which produce from salt dome structures of Mesozoic age.)

The report continued: Substantial industrial reserves of oil and gas were brought to light and prepared for exploitation as a result of successful geo-

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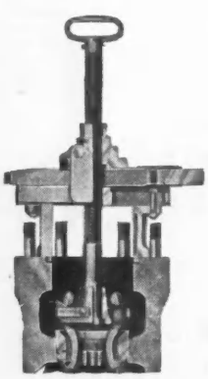

Provides a fast and positive means for pulling badly stuck valve seats by gripping the bottom rim of the seat. Eliminates the expense and hazards of removing seats with a cutting torch. All parts are made of highest grade alloy steel. Write for Catalog No. P-111.

CONSULT YOUR COMPOSITE. For full information on Red Devil Valves, Pullers and other Products, see Composite Catalog or write for price catalogs noted above. Red Devil Products are available through your supply store.

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Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .400"	Fontana, Calif.
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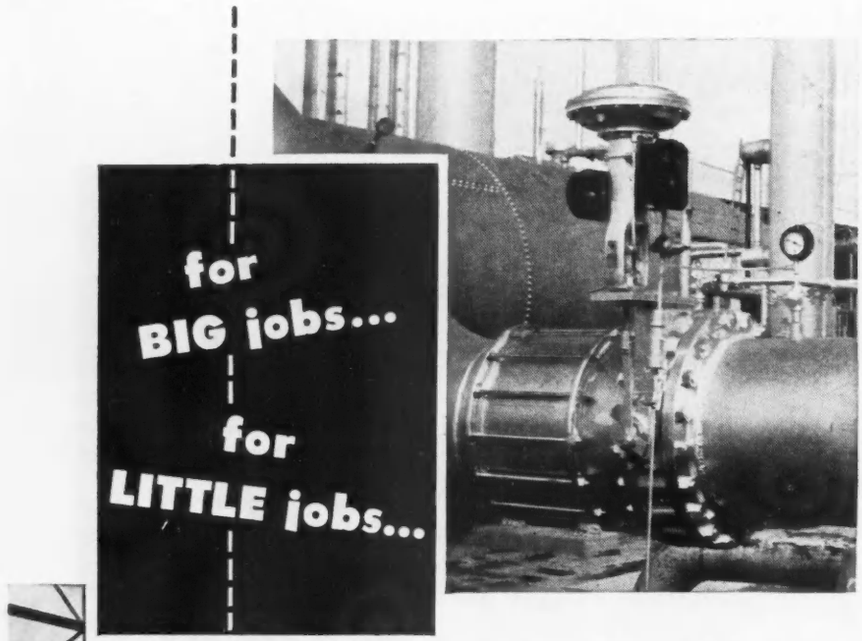
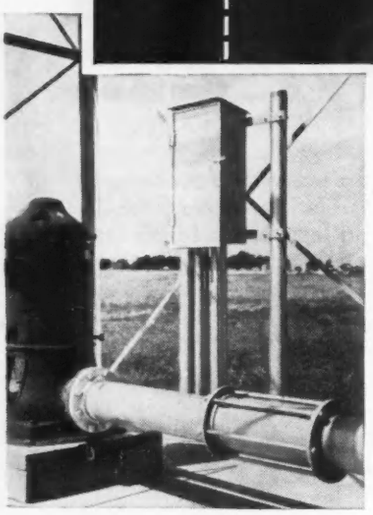
logical prospecting. A new technique in oil extracting, drilling of wells and processing of oil is being widely introduced. The production of high-octane aviation fuel and aviation oils was expanded and the quality of oil products improved. New oil processing plants and installations fitted out with modern Soviet equipment were built and large trunk oil pipe lines were constructed. At the same time, the swift rise in oil production demands a still more accelerated building of new processing plants.

The significance of new oil districts in the East (Asiatic Russia) increased considerably. New big oil fields and oil processing plants were set up in the Baskir Autonomous Soviet Socialist Republic. (This state is just west of the Ural Mountains and its southern border is about 400 miles northeast of the Caspian Sea.) The production and processing of oil is swiftly developing in the Kuibyshev Region (just west of Baskir); in the Turkman (just east of the lower Caspian and immediately north of eastern Iran); Uzbek (just east of Turkman), and Kazkh (on the northeastern border of the Caspian) republics. New big oil deposits were discovered in the Tatar Republic (northwest of Baskir and north of Kuibyshev). The share of eastern districts in the total oil output of the USSR increased to 44 percent as against 12 percent in 1940.

A part of the claimed progress of the Russian State Planning Committee for the oil industry may have been in some degree a result of the success reported by the committee for the steel industry under its five-year plan. It was stated that the level of production for the rolled ferrous metals set by the five-year plan for 1950 was reached in the third quarter of 1949, and the level of steel production in the second quarter of 1950. It was claimed the 1950 total output of ferrous metals exceeded the prewar level by 45 percent, or 10 percent above the assignment of the five-year plan. It was added that the iron and steel industry of South Russia, completely destroyed in the war, was restored on a new technical basis and it produces more metal than before the war.





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ECA Quota for Germany's Imports Set At $6,759,000

The European Cooperation Administration has released $6,759,000 in Germany for the outstanding crude imports from dollar concessions in the second quarter. Arabian American Oil Company will furnish in excess of 2,010,000 barrels and Venezuela will export 760,350 barrels. Aramco oil will be distributed to Deutsche Vacuum, Bremen-Oslebshausen; Esso, Hamburg-Harburg; Gelsenberg Benzin AG., Gelsenkirchen; Deutsche Erdoel-AG., Heide; BASF, Ludwigshafen; Venezuelan crude will be distributed to Esso, Hamburg-Harburg, and Deutsche Gasolin, Dollbergen.

Crude imports into Western Germany in 1950 totaled 15,887,518 barrels. The Near East furnished 82.4 percent, and Venezuela the remainder.

Reds Set Polish Goals

Communists have set as a goal for Poland's 1955 crude production an output of between 7000 and 8000 barrels per day, as compared to an estimated production in 1950 of 3000 barrels daily. The Cominform has established a natural gas production goal of approximately 17 million cubic feet a day for the new five-year plan.

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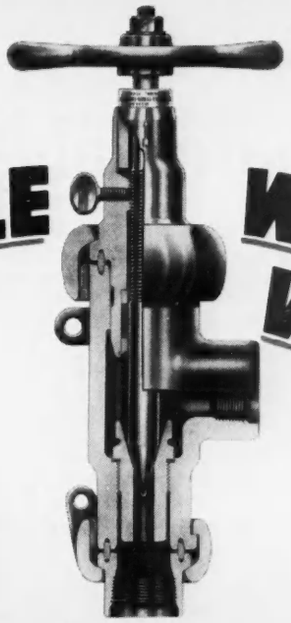
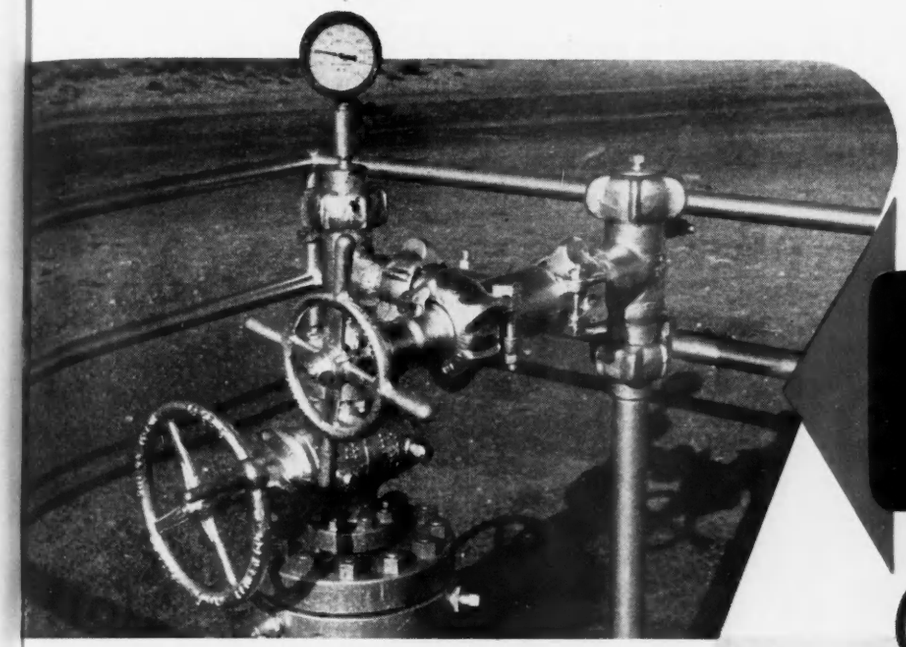
The new UNIBOLT ADJUSTABLE WING VALVE





On high pressure wells, IT'S A DEPENDABLE, LOW COST WING VALVE

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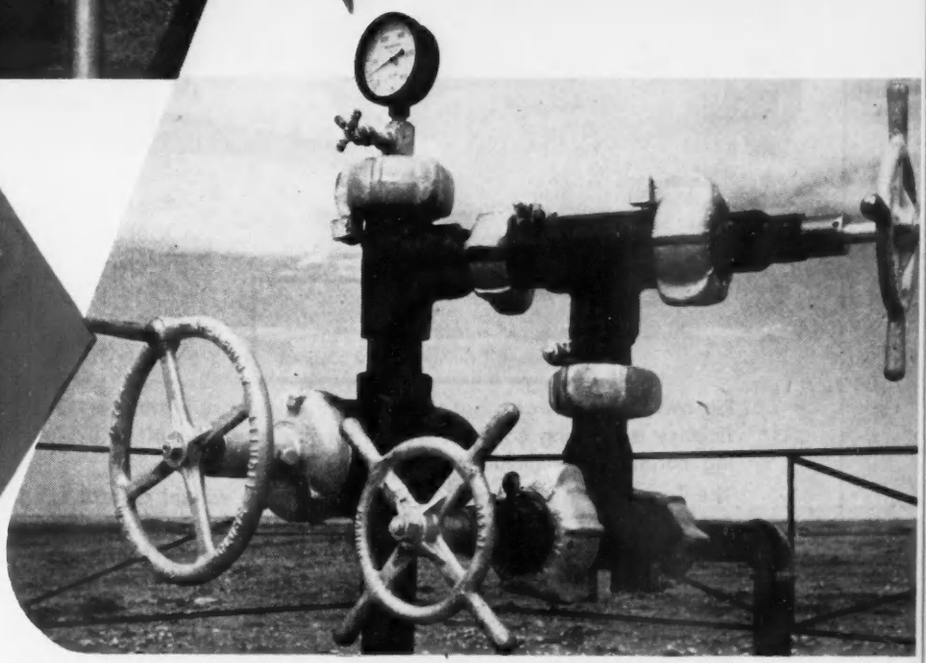

The UNIBOLT Wing Valve, designed originally for use as an adjustable choke where well conditions did not demand a positive choke, has become popular with production men as a dependable valve for numerous services where a positive shut-off is essential. Christmas trees for both producing and injection wells, high pressure oil and gas separator manifolds, heater manifolds, meter runs and similar services are made to order for this dependable, yet relatively low-cost, valve. Since high pressure wells are usually produced through a small positive choke, the one-inch opening provided in the UNIBOLT Wing Valve when in full open position is ample to assure unrestricted flow. An additional advantage is the replaceable stem and seat, which may be changed in the field, easily and at low cost. A recent refinement in its mechanical design is the stem packing which, after the valve is assembled at the factory, never requires adjustment or tightening.

Having standard UNIBOLT Couplings between its component parts, the UNIBOLT Wing Valve is easily dismantled or assembled, and may be readily converted to a Positive Choke Body by substituting a blanking plug and positive bean for the stem and seat assembly.

Available in 6,000, 10,000 and 15,000 lbs. test, and in corrosion resistant alloy.

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International Accepts DeMares Proposal

AN internationally-significant working agreement has resulted from Colombia's desire for International Petroleum Company, Ltd., to participate in the De Mares producing and refining concession after the company's rights expire August 25 and the government's Empresa Colombiana de Petroleos takes possession.

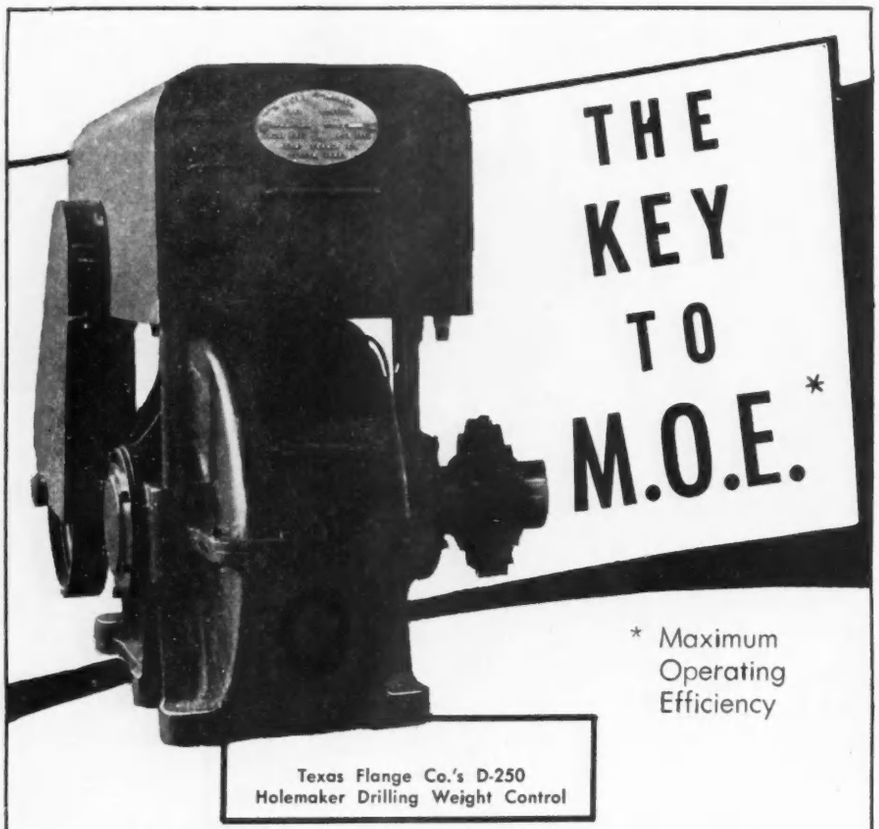
The significance of this agreement lies in its being the first instance in which a foreign-held oil concession has reverted to a government for operation through normal term expiration. It is unique in that the concessionaire rejected proffered contracts from Colombia providing a profit opportunity for technical assistance on production and management of refining in favor of these two agreements:

- For International to advise on producing activities of the four De Mares fields on a cost-plus basis.
- For a lease permitting International to continue operating its Barranacbermeja refinery, which also becomes an Empresa property.

For Colombia, the agreement assures its initial venture into the oil industry will have the best advice of International's 30-year experience in De Mares producing operations and the guarantee that the refinery supplying the major portion of the nation's petroleum product requirements will continue to operate in expert hands.

For International, it provides a source of crude supply and refinery capacity for its subsidiary, Esso Colombiana, S. A., in its role as the largest marketer in Colombia and a possible balance for export after domestic needs are filled.

International currently holds exploration concessions on an additional 2.5 to 3 million acres in Colombia.



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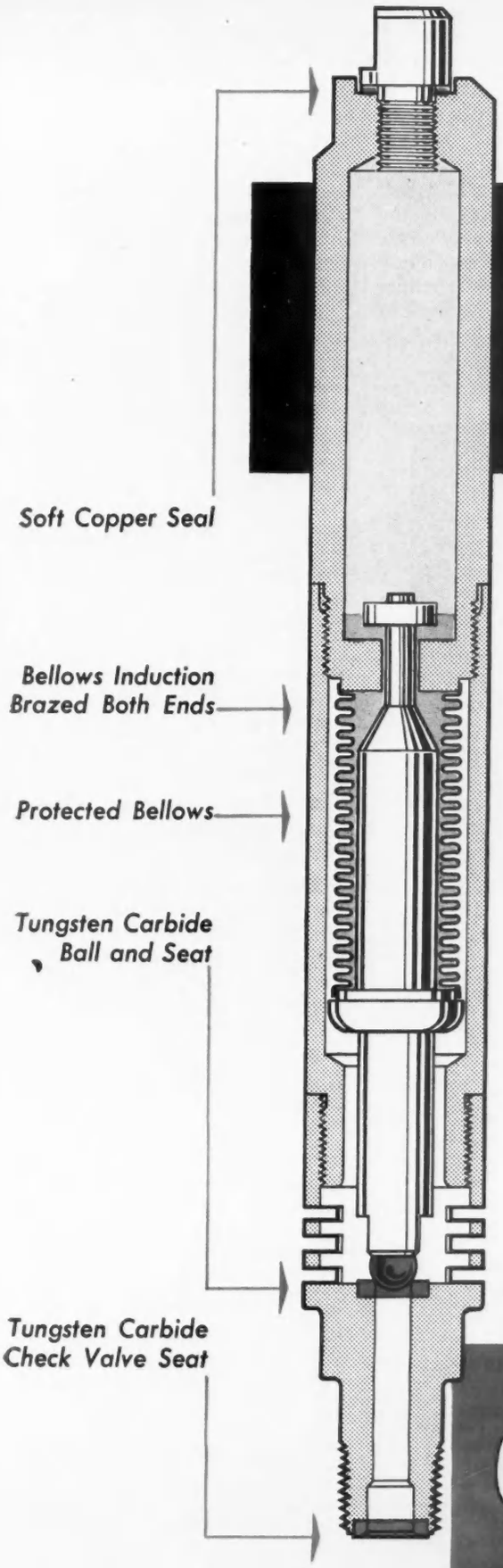
Reported Agreement on Iraqi Squabble Denied by British

Iraq Petroleum Company officials termed as unfounded a report from Baghdad that the company had reached an agreement with the Iraqi government on a 50-50 division of profits from Iraq oil production, and a stalemate continued late last month over British attempts to remove an Egyptian blockade that has prevented shipments from passing through the Suez Canal bound for Israel.

The blockade of shipments to Israel has been enforced by the Arab League nations, technically still at war with Israel despite the truce which ended the actual Palestine fighting in 1948. The Israeli-Arab conflict prevented the completion of Iraq Petroleum's 16-inch crude line to Haifa and the Arab League subsequently closed down oil movement through the existing 12-inch line from Iraq to the British controlled Consolidated refinery at Haifa. With the stoppage of exports from Iran, added urgency has been given to the need for reopening the Suez to petroleum shipments to supply the Haifa refinery.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New Law Hastens Italian Nationalization

NATIONALIZATION of the Italian oil and gas industries has been accelerated by the approval of a new mining law and the establishment of Ente Nazionale Idrocarburi, a government agency under which all government petroleum activities throughout the peninsula are to be incorporated. Under the projected plan, the Italian treasury will supply ENI with more than $20 million as a shoring action for the promotion of gas and oil production and processing. In addition, to ENI will go assets acquired heretofore by the state in its peninsular oil enterprises.

Since European Reconstruction Program funds are used to strengthen the Italian state budget, American tax monies are being used to assist in the nationalization of this Italian oil and gas industry.

In this connection, the Italian government, while confirming that ENI will hold a research work monopoly in the Po Valley, emphasized that rights acquired by private oil and gas companies there will be recognized. Officials also said ENI will be authorized to sub-contract research and exploitation work in the Po Valley to privately-owned enterprises.

That Italy expects its new controlled-procedure to succeed is evidenced by the negotiations with Iranian Premier Mossadegh for an Italo-Persian oil agreement. Initiated by Dr. Carafa d'Andria, vice chairman of Azienda Generale Italiana Petroli, the discussions were opened in the hope that the change wrought in the Persian Gulf petroleum industry by the furore over Iranian nationalization might create new opportunities for the Italian oil industry and trade.

As approved by the cabinet, the new mining law provides, in part:

- For the concession of research and exploitation permits over surfaces not exceeding 7413 acres.
- That each research permit issued for an initial three years may be extended to six years, and to nine years if the permit holder is complying with the law. Further extension of three years might be granted should gas or oil be discovered.
- That the research permit holder is guaranteed the right to exploit gas or oil resources he discovers.

Several Italian oil and gas quarters have voiced dissatisfaction that the law does not guarantee the government will refrain from extending to Central and South Italy the monopoly regime established in the Po Valley. The risk to the permit holder, who after three or six years of intense exploration activity might find himself governed by new policies, was emphasized in these circles.

Germany Has Gasser

Natural gas in economic quantity was discovered in Frenswegen 1 north of Nordhorn, a town near the German-Dutch border, at a depth of 6316 feet. The gas-bearing formation (Plate dolomite of Zechstein) is the same as in the natural gas field of Bentheim, situated farther south.

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The Trading Post

Houston Nomads guests at the July meeting included, left to right: Mike P. Robinson, Bahrein Petroleum Company, Ltd., Persian Gulf; Walter Van Meers, W-K-M Company, Inc., San Francisco; H. C. Duke, The Caribbean Petroleum Company, Maracaibo, Venezuela; L. L. McWilliams, Socony-Vacuum Oil Company, C. A., Venezuela; Dick Godfrey, Bahrein Petroleum, Persian Gulf; and J. K. Scott, Creole Petroleum Corporation, Maracaibo, Venezuela.

Aramco Has Two Discoveries

SAUDI Arabia, which recently became the leading oil producing nation of the Middle East with daily average output at a little more than 740,000 barrels, has increased its productive potential with two successful discoveries this year by Arabian American Oil Company. The wells are Saudi Arabia's initial discoveries since 1949, when the Haradh and Fadhili fields were found. They bring to nine the known oil fields in the country.

The most recent discovery, Safaniya 1, is the first offshore well drilled in the region, and is about 12,000 feet out in the Persian Gulf in approximately 20 feet of water. Location is about 13 miles south of the port of Ras el Misha'ab in northern Saudi Arabia, near the northern limit of Aramco's concession area. It was spudded in late in January (see WORLD OIL, February 1, 1951).

Oil was discovered in the Bahrein Zone, the producing horizon of the Bahrein field of Bahrein Island and the Burgan field in Kuwait. From preliminary drill-stem tests Aramco officials said it has been determined the oil is sweet and of medium gravity. Operations continued and it was planned to core through the pay zone.

The Bahrein field, discovered in 1932, produces 33.5-gravity crude from a limestone formation of Cretaceous age at 2000-2300 feet. The structure is on an anticline. The average thickness of the pay is 200 feet. Kuwait's Burgan field, discovered in 1938, produces 32.5-gravity oil from a sand formation of Middle Cretaceous age with the pay zone from 3600 to 4800 feet.

The earlier 1951 Saudi Arabian discovery of Aramco, announced in May, is Ithmaniya 1, about 40 miles south of the Ain Dar field, a 1948 discovery, and 20 miles west of the town of Hofuf. It has been indicated that the oil is sour and of 30.5 gravity and preliminary tests were made at 6900 feet. The producing horizon is understood to be of the Arab limestone zone of Jurassic age, similar to the larger producing fields of Saudi Arabia. The nearest field is Ain Dar, which was only placed on commercial production during 1951 with completion of a 28-mile, 22-inch pipe line to the Abqaiq field, Saudi Arabia's largest producer.

Saudi Arabia's crude production is from Abqaiq, Ain Dar, Dammam and Qatif fields with production closed in for lack of pipe line outlets from the Abu Hadriya (discovered in 1940), Fadhili (1949) and Haradh (1949) fields in addition to the two new discoveries.

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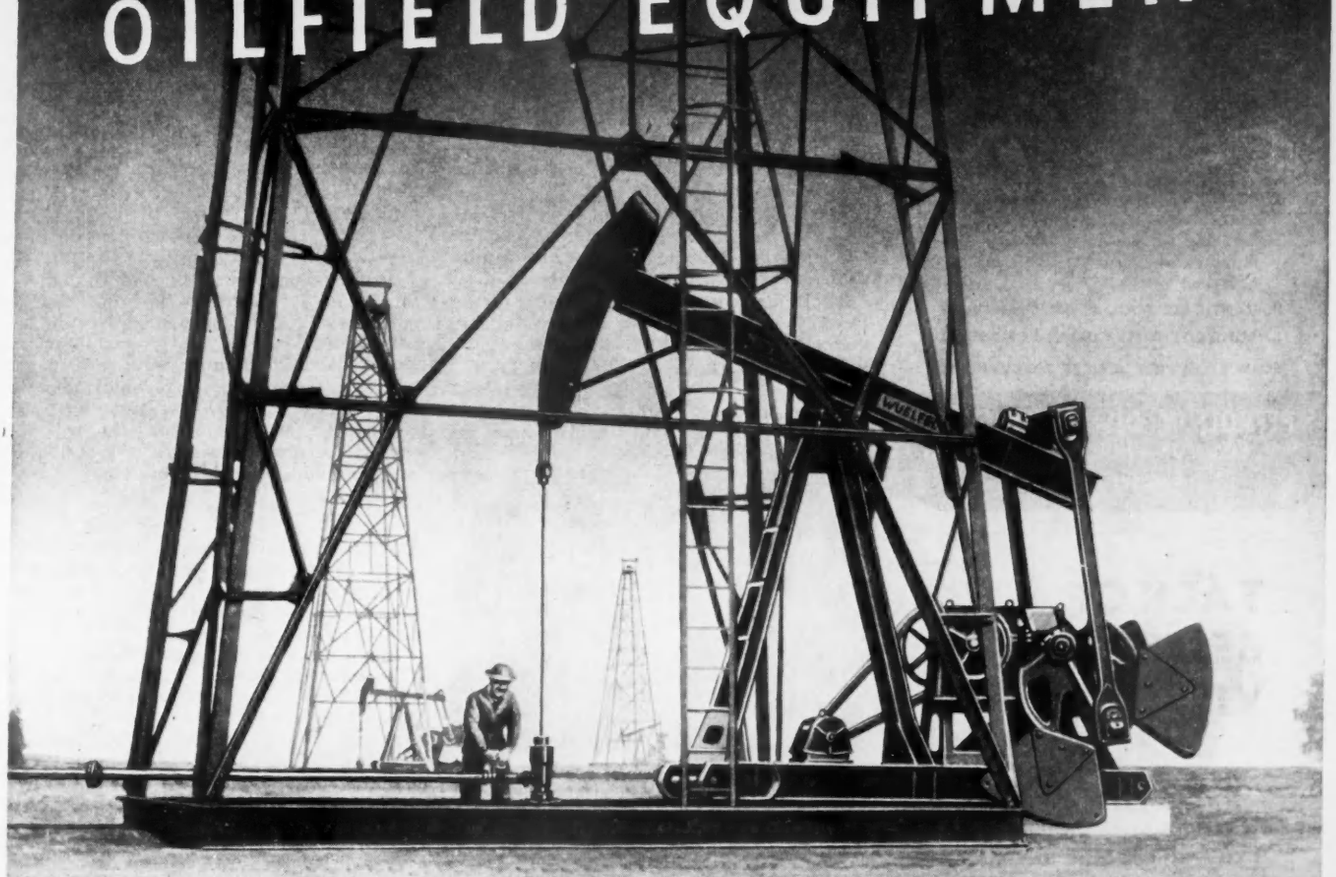
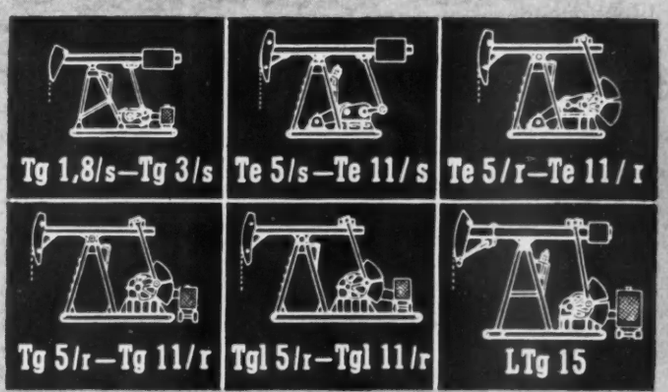


Individual Pumping Units with Beam or Crank Counterbalance.

Long stroke lengths increase the service life of pumps and sucker rods and reduce the frequency of pump changes.



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Men in the Industry NEWS

L. F. Athy

J. A. Culbertson

Dr. L. F. Athy, manager of the Geophysical department of Continental Oil Company, has been promoted to manager of the Exploration department.

Dr. J. A. Culbertson, chief geologist, was promoted to assistant manager of the Exploration department, retaining his position as manager of the geological section.

H. R. Prescott, assistant manager of the Geophysical department, promoted to manager of the geophysical section.

Dr. Athy, who received his Ph.D. degree in geology from the University of Chicago, has been with Continental more than 26 years. He joined the company as a geologist in 1925 in Ponca City, Okla. He became chief geophysicist in 1936 and manager of the Geophysical department in 1948.

S. K. Clark

H. R. Prescott

Dr. Culbertson received his Ph.D. degree in geology from the University of Illinois and joined Continental in 1933. Rising to division geologist in the Houston division, he was promoted to assistant manager of the Geophysical department in 1948, at Ponca City, and named chief geologist in 1949.

Prescott, who received his B.S. degree in engineering from the University of Kansas, joined Continental as an engineer in 1928. He was promoted to assistant chief geophysicist in 1939 and moved up to chief geophysicist in 1948. He became assistant manager of the Geophysical department in 1949.

S. K. Clark, coordinator of exploration activities, has been promoted to manager of the newly created Royalty department. Clark, who received his B.S. degree in engineering from the University of Nebraska, joined Continental as a geologist in Ponca City in 1924. He had served as chairman of the exploration committee before becoming exploration coordinator.

Dr. Harold Gershinowitz has been made a vice president of Shell Oil Company, in charge of the company's new technical services organization in Houston. Dr. Gershinowitz has been in charge of Shell's division of Exploration and Production Research and has been in charge of the Houston area production laboratory at Bellaire, Texas. He joined Shell in St. Louis as a research technologist in 1938, transferred to Houston in 1940. He went to New York in 1942 and returned to Houston in 1945.

H. Gershinowitz

Assisting Dr. Gershinowitz in the new service will be **Dr. Noyes D. Smith, Jr.,** research manager in charge of the laboratory, and **J. Chalmers,** technical service manager. **F. Goldstone** is exploration assistant and **Dr. F. Brons** is production assistant. **W. L. McKinnon** is office manager.

The new unit will serve exploration and production activities of the company throughout North America, and will also provide advanced training for specialists of oil exploration and production.

•

W. Baxter Boyd, formerly area geologist of the Fort Worth area for Continental Oil Company, has been appointed manager of exploration for Republic Natural Gas Company, Dallas.

Boyd, graduated from the University of Oklahoma in 1928, had been with Continental 18 years, working continuously in the Mid-Continent fields.

J. H. Hester, former drilling superintendent for Republic, has been named general superintendent. **C. C. Book,** district superintendent in Oklahoma, has been transferred to Dallas as assistant to Hester.

•

J. W. Hudson has been appointed general superintendent of Deep Rock Oil Corporation's crude oil production, with offices in Tulsa. A petroleum engineering graduate of the University of Texas, Hudson served four years with the U. S. Navy before he joined Republic Natural Gas Company in 1945 as district engineer. Previously he had worked part-time during school vacations for Humble Oil & Refining Company and North Basin Pools Engineering Committee.

•

Jesse A. Rogers has been promoted to senior geologist in the West Texas division of The Texas Company's Producing department, with offices in Fort Worth. He was formerly district geologist at Midland, Texas, where he is replaced by **Robert H. Martin,** who has been district geologist at Abilene. **N. D. Raman,** geologist at Fort Worth, has been advanced to succeed Martin at Abilene.

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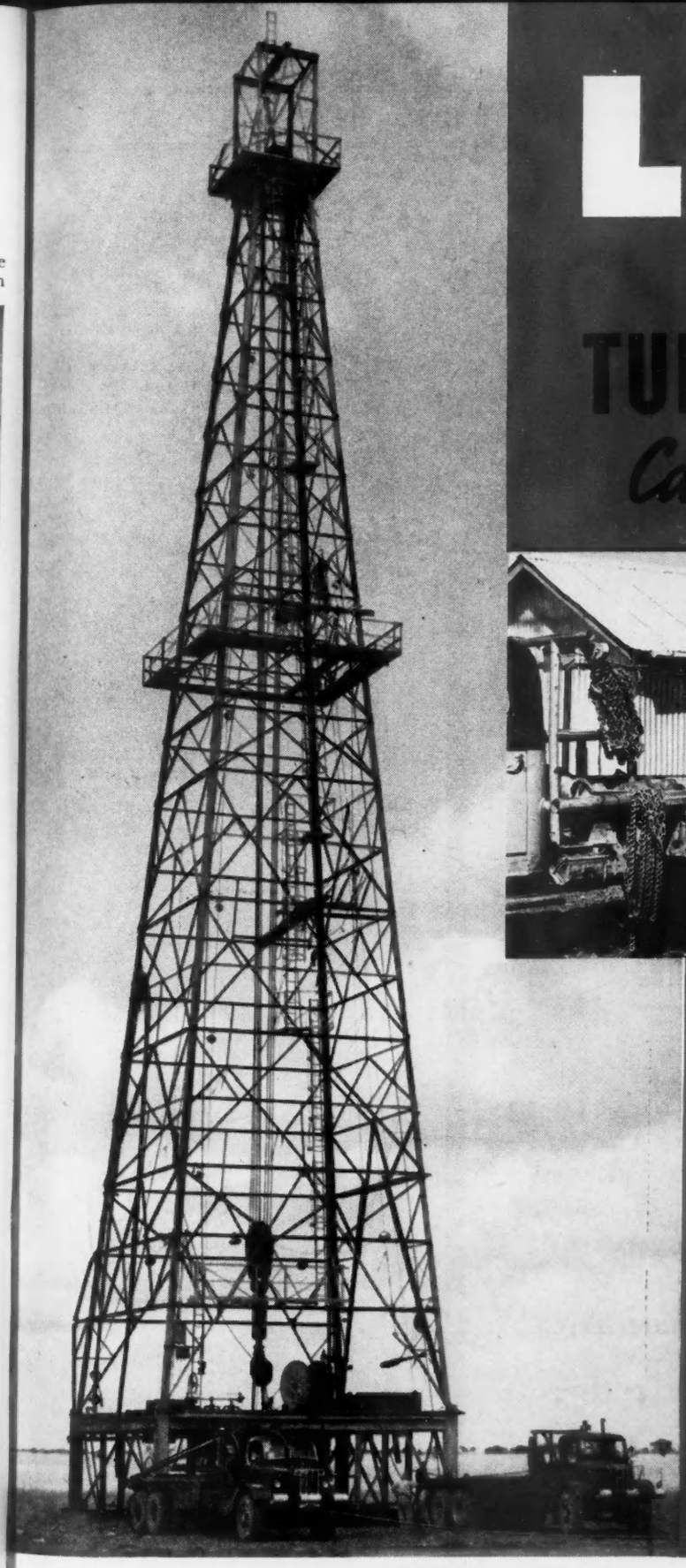

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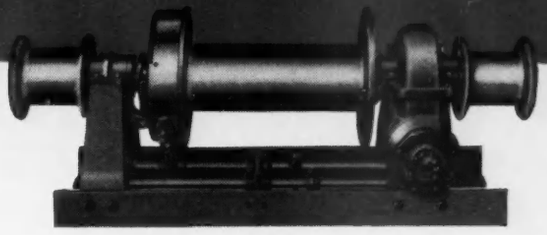

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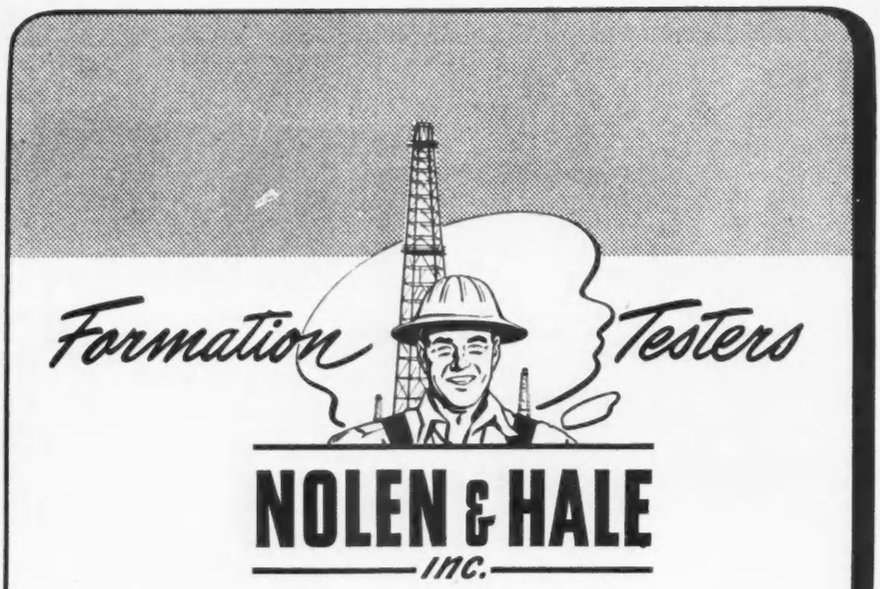
R. I. Williams has been named assistant general superintendent of crude oil production for Lion Oil Company. Williams, now completing his 13th year with the company, moves up from the post of Southern division superintendent.

A. W. Wood, recently with the Production department of Phillips Petroleum Company, has joined Lion to succeed Williams as Southern division superintendent. He is in charge of operations in Louisiana, Mississippi, South and East Texas, and South Arkansas (with the exception of the Shuler Unit).

O. E. Van Meter, Jr., has been named assistant division petroleum engineer of Magnolia Petroleum Company's Gulf Coast division with headquarters in Houston. Van Meter has been on a leave of absence for the past nine months taking graduate work at Texas A. & M. College. Before that he was a petroleum engineer in the West Texas division.

William E. Allen has been promoted from assistant foreman in Magnolia's Brownfield Producing district to production foreman in the Kermit district.



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A. G. McNeese, Jr., formerly with the Glenn H. McCarthy interests, has joined the staff of Houston Oil Company of Texas and its subsidiaries as administrative assistant to **Harold Decker,** president.

A. G. McNeese, Jr.

McNeese was graduated from the University of Texas with a degree in law and was with Fulbright, Crooker, Freeman & Bates before joining the McCarthy interests in 1941. He served variously as general counsel, vice president, and director of several of the McCarthy companies.

Willard Gill has joined American Republics Corporation as assistant to the president in exploration matters. Gill received his master's degree from Baylor University and later spent two years in graduate school at Columbia University. He began his career as instructor in geology at Baylor, then joined The Pure Oil Company in Illinois, later working in Oklahoma, Louisiana and Texas. He was regional geologist for H. L. Hunt at Jackson, Miss., then named assistant chief geologist with Union Sulphur Company. His most recent position was that of chief geologist for Danciger Oil & Refining Company and its successor, Southern Production Company.

Willard Gill

Dixon H. Cain, formerly district petroleum engineer for Union Producing Company in the Houston district, has joined Fifteen Oil Company, Houston, as vice president in charge of drilling and production. Cain, a graduate of the University of Texas, served in the U. S. Navy 3½ years during World War II. He was employed in the Production Engineering department of Union Producing Company in Shreveport in 1941 as assistant petroleum engineer and was transferred to Houston in 1946.

Dixon H. Cain

Cedric W. Lutz has been appointed director of purchases for Gulf Oil Corporation, Pittsburgh. He has been assistant to the vice president in the Houston Production division.

Lutz will be in charge of all purchases made in the U. S. by all Gulf companies, and will determine purchasing policies and procedures for all the companies' domestic divisions and districts.

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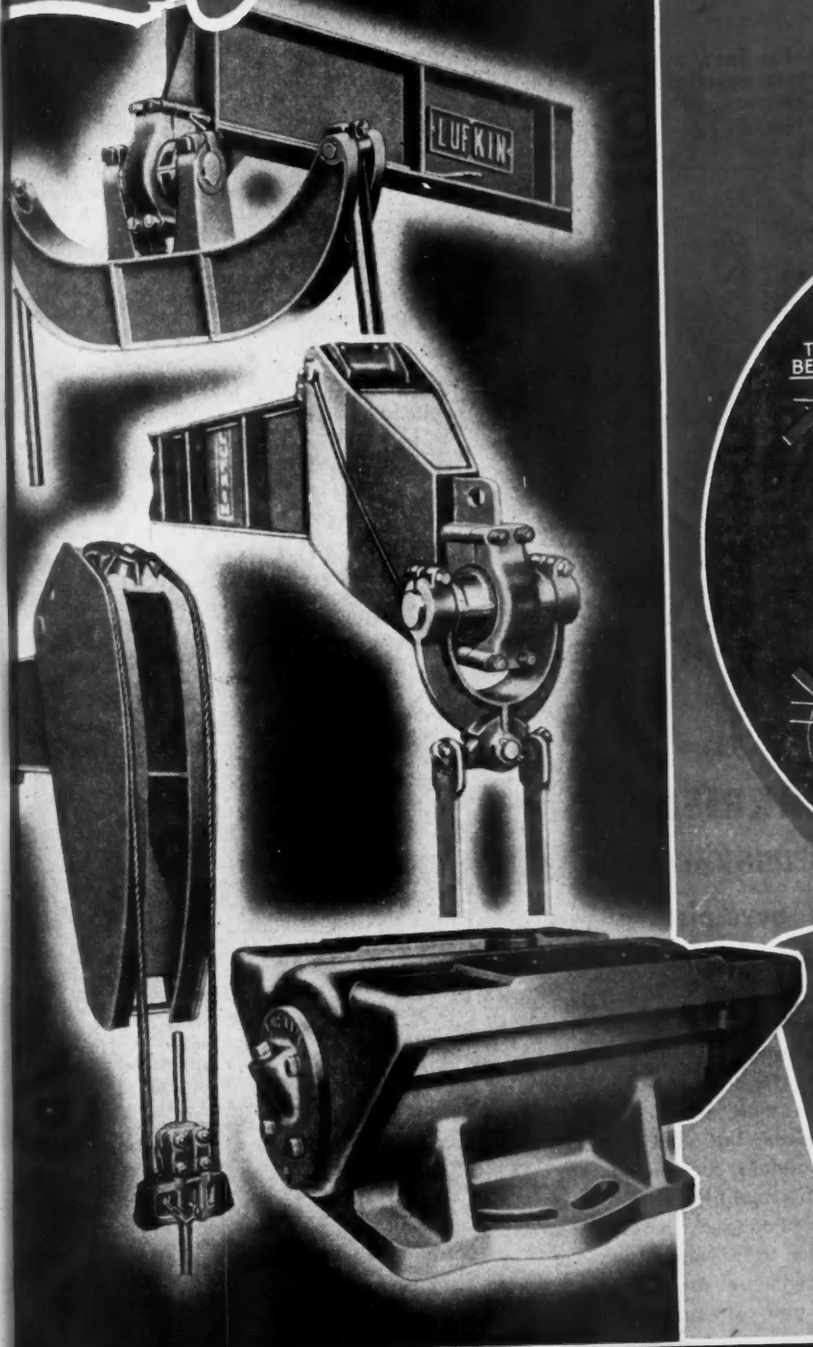

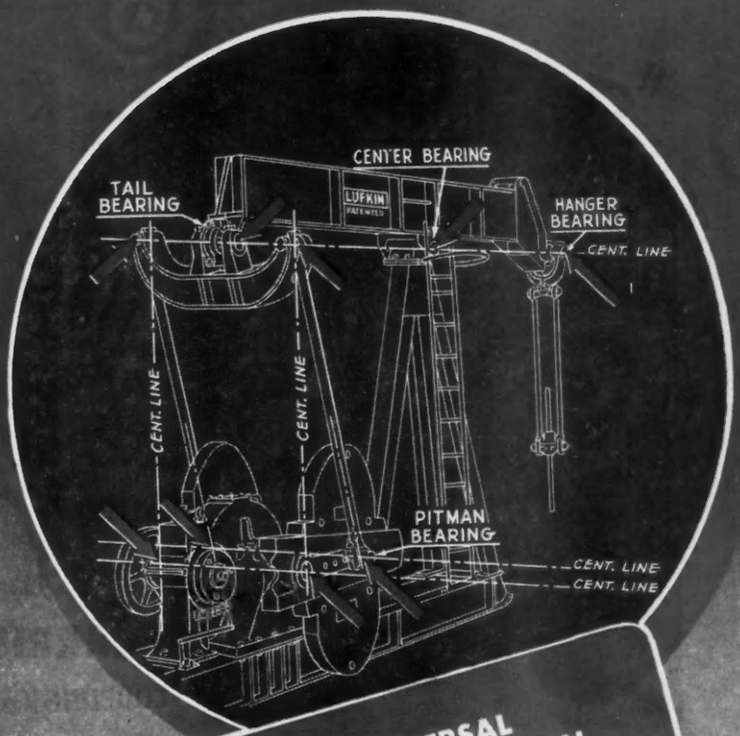

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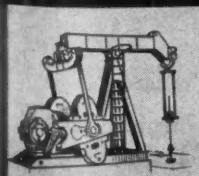
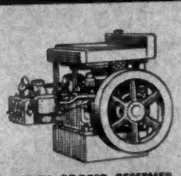


LUFKIN PUMPING UNITS



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Leon M. Sipes has been appointed editor of publications for Texas Eastern Transmission Corporation. Sipes, formerly general manager of Radio Enterprises, Inc., El Dorado, Ark., has been in radio and editorial work since 1932, and has been manager of Radio Station KELD since 1943. Prior to that time, he was assistant advertising manager for an oil company.

•

John W. Branson, formerly with Magnolia Petroleum Company in San Antonio, is now with Federal Royalty Company, Houston, as geologist.

George G. Oberfell, retired vice president of Phillips Petroleum Company, Bartlesville, Okla., received the Distinguished Service Award of the Liquefied Petroleum Gas Association in recognition of his research and scientific contributions to the advancement of the LP-gas industry.

•

F. L. Lee has been appointed assistant chief petroleum engineer of Union Pacific Railroad Company, with headquarters at Los Angeles.

E. G. (Gene) Baker, Tulsa, Service Pipe Line Company supervisor, has been named assistant chief of the transportation materials branch of the Petroleum Administration for Defense. Baker has been supervisor of the wage and salary section of the company's Industrial Relations department since 1945 and is a specialist in job evaluation studies and material allocation. His appointment marks the second time Baker has served the federal government in an emergency petroleum agency. During World War II he was an expeditor of materials for construction of oil pipe lines.

E. G. Baker

•

W. H. Marshall has been named district geologist at Shreveport for Union Producing Company. He succeeds **C. C. Clark,** retired, who has entered the consulting field.

•

Earl West and **G. L. Helmke** have resigned as geologists from Continental Oil Company and Stanolind Oil and Gas Company, respectively, to open offices as consulting geologists at Casper, Wyo.

•

Gordon Kirby has resigned from Petty Geophysical Company and has been named Rocky Mountain geologist for Murphy Corporation, Denver. **Nolan Ashburn** has also joined the Murphy geological staff.

•

James D. Burke, former district geologist for Seaboard Oil Corporation in Corpus Christi, Texas, has resigned to become a consultant. He is associated with **O. G. McClain** at 426 Wilson Building, Corpus Christi.

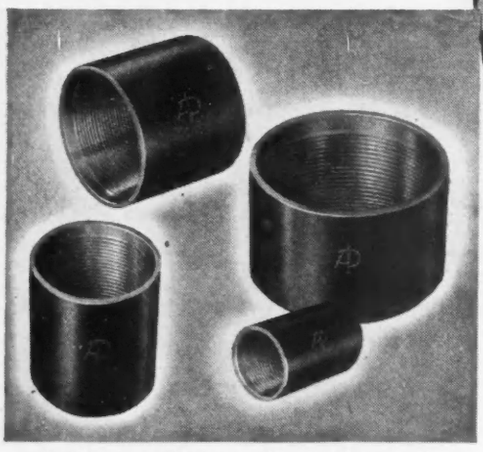
•

Fred H. Moore has been appointed assistant to **J. L. Latimer,** president of Magnolia Petroleum Company.

Moore holds a master's degree in geology from the University of Virginia and also spent two years in the graduate school of geology at Yale University. He joined Magnolia in 1935 as a field geologist in Oklahoma and was transferred a year later to Midland, Texas, where he worked four years as a geologist in West Texas. After working in the Kansas, Ohio, North Texas and Illinois geological districts, he was sent to Roswell, N. M., to open Magnolia's geological offices there in 1947. Two years later Moore was transferred to the general offices in Dallas as staff geologist. In March, 1950, he was assigned staff duties in the executive offices.

Fred H. Moore

"Since I was a boy—darned near.."



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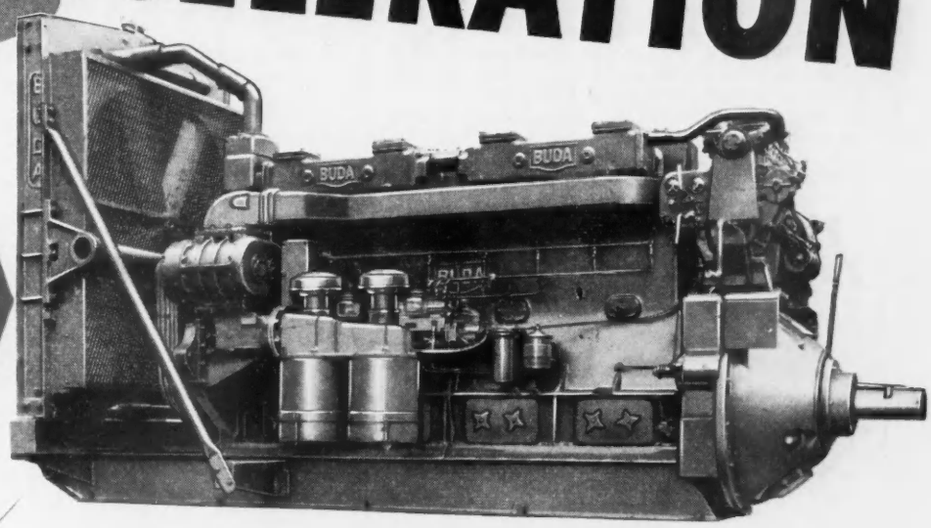

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Carl J. Maki has joined Seaboard Oil Company of Delaware, Dallas, as manager of the Gas and Gasoline department. A graduate of the University of Minnesota, he was formerly assistant chief of the Gas branch in the Production department of Gulf Oil Corporation, Pittsburgh.

R. E. Heithecker, formerly in the Gas and Gasoline department, has been placed in charge of the newly created Reservoir Engineering department in Seaboard's Dallas office.

M. J. Heald has relinquished his duties as division manager, Oklahoma division, Producing department, The Texas Company, and remains with the company only in a consulting capacity. He has had more than 40 years experience in the oil business.

Mark L. Terry, assistant division manager, succeeds Heald in the division managership in Tulsa.

Heald started in the oil business in 1910 as a drilling contractor and producer. From 1917 to 1922 he worked in the Production departments of various oil companies, and then operated as a drilling contractor in Oklahoma and Kansas until 1925. After working for Marland Oil Company, he joined The Texas Production Companay (Colorado), a subsidiary of The Texas Company. After a series of advancements and transfers, he became assistant division manager at Denver in 1937, then assistant division manager, Oklahoma-Kansas division, 1938-1946. In November, 1946, he was named manager of the Oklahoma division.

Terry, a 1920 graduate of the University of Missouri School of Mines, worked for Josey Oil Company from 1920 to 1929, when The Texas Company bought Josey.

•

Warren A. Sinsheimer, vice president of Petroleum Advisers, Inc., a Cities Service Company affiliate, has been appointed petroleum economics coordinator, a newly created company position. Under his direction, broad economic studies within the petroleum industry as well as those of a general nature will be made. Sinsheimer, a graduate of the University of California, in 1917, joined Cities Service in Oklahoma in its Production and Engineering department. He is also vice president and director of Cities Service Petroleum Company and Cities Service Pipeline Company, and director of Empire Gas & Fuel Company, Arkansas Fuel Oil Company, and Arkansas Pipeline Company.

W. A. Sinsheimer

•

Lenox A. Fitch has resigned as district Landman for Sohio Petroleum Company, Lafayette, La., to become assistant manager of the Land department for Pan Am-Southern Corporation at Shreveport.

•

W. D. Frazzell has resigned from Ray and Woolf, Shreveport, to represent **N. H. Wheless** as geologist and agent in the Permian Basin, with headquarters at Abilene, Texas.

•

Jim Armour has been appointed acting secretary-treasurer of the Laura Jane Oil Company, Wichita, replacing **H. D. Shawver**, resigned.

•

E. Darrell Williams, consultant, has moved from Lander, Wyo., to Houston, where he will continue to engage in general oil exploration, specializing in seismic interpretations.

•

M. E. Michael, development foreman of Phillips Petroleum Company's Gulf Coast Production division, has been appointed district superintendent at Beaumont, Texas, succeeding **H. M. Bell**, resigned.

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J. French Robinson has been elected chairman of the board of The East Ohio Gas Company, and has been succeeded as president by **William G. Rogers.**

Rogers studied civil engineering at Case Institute of Technology in Cleveland before joining East Ohio in 1914 as a beginner in the engineering department. He was in the Army from 1917 to 1919, when he returned to East Ohio. He became assistant secretary in 1931, and secretary-treasurer in 1933. He was made vice president in 1939, and was promoted to executive vice president last year.

Before becoming president of East Ohio in November, 1940, Robinson was president of The Peoples Natural Gas Company and The New York State Natural Gas Corporation.

•

Col. Frank E. McMillin, former Oklahoma independent oil man, has been elected executive vice president of Hugoton Plains Gas and Oil Company, with headquarters in Tulsa.

•

W. R. (Bill) Edmonson has resigned as landman for Frontier Refining Company and is now associated with **Joseph S. Rose,** formerly of Jackson, Miss., as an independent.

G. A. Welsh

C. A. L. Walker

G. A. Welsh, formerly assistant to the traffic manager, has been named traffic manager of Great Lakes Pipe Line Company.

Retirement of **C. A. L. Walker,** vice president, was also announced. Walker has been an administrative and executive member of the pipe line company since its organization in July, 1930, first as traffic manager and recently as vice president. He continues with Great Lakes as consultant.

•

B. E. Groenewold has been appointed manager of Exploration Drilling Company. Other appointments include those of **Bruce Harp** as assistant manager, and **C. J. Matthews** as Rocky Mountain drilling superintendent.

B. E. Groenewold

A graduate of Massachusetts Institute of Technology, Groenewold has spent more than 26 years in the Mid-Continent oil industry, having worked for Cities Service, The National Supply Company, and Bethlehem Supply Company. He has previously been chief engineer and assistant manager of Exploration Drilling.

Harp, who will have offices in Midland, Texas, formerly was drilling superintendent for the Mid-Continent area. Matthews' headquarters will be in Riverton, Wyo.

•

James W. Adams, Jr., geologist of Shreveport, has joined the Production department of Houston Natural Gas Corporation in Corpus Christi, Texas. He obtained his B.S. degree from the University of Oklahoma. He was formerly an employe of The Carter Oil Company in Tulsa.

•

Dean A. McGee, executive vice president, Kerr-McGee Oil Industries, Inc., Oklahoma City, has been awarded the Erasmus Howard distinguished alumnus award by the University of Kansas.

•

Harry H. Heimple, Wichita, Kansas, has been elected president of Derby Oil Company, succeeding **H. E. Zoller,** resigned. **W. G. Tierney** was named executive vice president. Zoller, who is now an independent operator, was re-elected to the board of directors.

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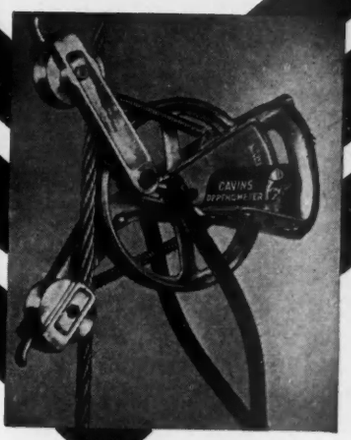

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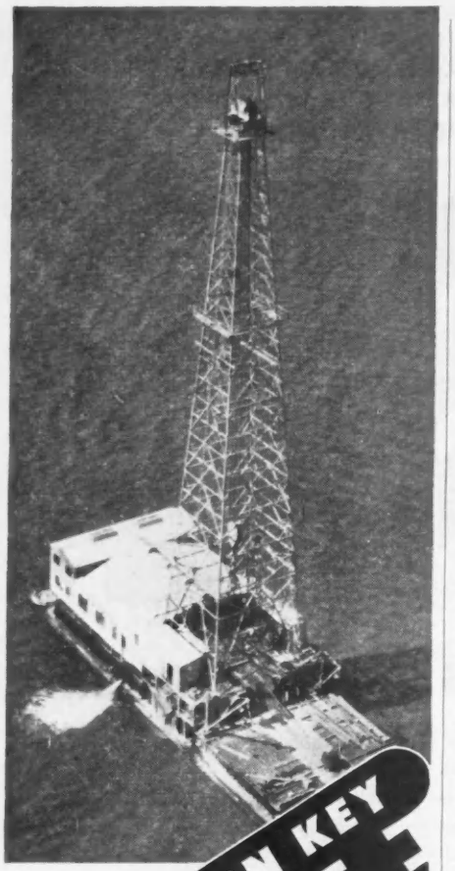

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Associations

Western Group Official Retires; Rogers Joins Washington Staff

David S. Kilgour has retired after 25 years with the Western Oil and Gas Association. Kilgour joined the group, then known as the Chamber of Mines and Oil, in 1925 as an auditor and became sucessively assistant secretary and secretary, the post he held at the time of his retirement. From 1933 to 1944, he was also secretary of the Pacific Coast section of the API Division of Production.

D. S. Kilgour

Frank Rogers, for the past five years Washington correspondent for the Los Angeles Daily News, has joined the association's staff as Washington representative. Rogers is a former city editor of the Daily News, former managing editor of the Ventura Star-Free Press and has worked on other newspapers in San Diego and Santa Ana, Calif.

Penn Grade Group Re-Elects C. E. Streeter for Third Term

C. E. Streeter, Bradford, Penn., oil producer, has been re-elected president of the Pennsylvania Grade Crude Oil Association for a third one-year term.

The group's board of directors named as a new officer C. A. Chipman, oil producer of Bolivar, N. Y., second vice president. George J. Hanks of Bradford, president of South Penn Oil Company, moved up from second to first vice president.

Other officers re-elected are F. B. Dow, Washington, D. C., vice president and general counsel; and Samuel Messer, president of Quaker State Oil Refining Corporation, treasurer; assistant treasurers F. W. Alcorn and C. L. Suhr, both of The Pennzoil Company, and W. R. Reitz, Quaker State; and W. C. Wenzel, executive manager. All the latter are of Oil City, Penn.

United Geophysical Employe Heads L. A. Desk and Derrick

Florence Hopkins, United Geophysical Company, will serve as president of the Los Angeles Chapter of the Desk and Derrick Club for the 1951-52 term. Other officers are Bea Landry, Tide Water Associated Oil Company, first vice president; Libby Hone, Schlumberger Well Surveying Corporation, second vice president; Lorraine Rich, Western Oil and Gas Association, treasurer; Evelyn Koebig, W. H. Geis, recording secretary; and Marie Brehm, Standard Oil Company of California, corresponding secretary. New board members are Ruth Stine, Signal Oil & Gas Company, and Evangeline LaRue, California Research Corporation.

Geophysicists Choose Hammer As President for 1951 Term

Dr. Sigmund Hammer, of Gulf Research and Development Company, Pittsburgh, was elected president of the Society of Exploration Geophysicists. Dr. Hammer served as vice president of the society during the past year.

Curtis H. Johnson, General Petroleum Corporation, Los Angeles, was elected vice president, and R. C. Dunlap, Jr., Geophysical Service, Inc., Dallas, was chosen secretary-treasurer. Paul L. Lyons, The Carter Oil Company, Tulsa, was elected editor of *Geophysics*, the society's journal, for a period of two years. Colin C. Campbell, Tulsa, continues as business manager of the society.

Marshall W. Peters, acting assistant purchasing agent of Humble Oil & Refining Company (front row, center), is the new president of the Houston Purchasing Agents Association. Other officers (seated) are J. F. Florian, first vice president; R. J. Gallagher, Metal Goods Corporation, national director and retiring president; Peters; Gene Walker, United Gas Corporation, second vice president; and N. E. Waldie, Humble, secretary. Standing, C. S. Frink, Dow Chemical Company, alternate national director; Lorain Williams, Peden Iron & Steel Company, John D. Mihalick, Emsco Derrick & Equipment Company, and F. Gayle Hawk, Shell Oil Company, local directors; and Charles O. Brotherton, Gulf Oil Corporation, treasurer.

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Petroleum Equipment Suppliers Elect Officers for 1951-52

Fred M. Mayer, Continental Supply Company, Dallas, was elected president of the Petroleum Equipment Suppliers Association at the sixteenth annual meeting of the group in Quebec. Other officers are Mason B. Jones, S. M. Jones Company, Toledo, vice president; Wharton Weems, Vinson, Elkins & Weems, Houston, treasurer; Leroy Jeffers, Vinson, Elkins & Weems, assistant treasurer; and H. R. Safford, Jr., executive secretary.

Eastern district chairman is H. B. Wehrle, McJunkin Supply Company, and vice chairman is A. S. Knowles, Parkersburg Rig & Reel Company. D. D. Bovaird, Bovaird Supply Company, is chairman of the Mid-Continent district, and E. C. Bolger, of W. C. Norris, Manufacturer, is vice chairman. Chairman of the Southwestern district is M. E. Montrose, Hughes Tool Company, with Wallace D. Wilson, Wilson Supply Company, as vice chairman. J. J. Pike, Jr., of Republic Supply Company of California, is chairman of the Pacific district, and W. Edgar Spear, Chiksan Company, is vice chairman.

Cameron Executive Is Elected Controllers Institute Leader

George L. Duwe, controller of Cameron Iron Works, Houston, since 1945, has been elected president of the Houston Control of the Controllers Institute of America.

G. L. Duwe

The 1951 annual meeting marked the tenth anniversary of the Houston Control and honored four of the seven charter members of the group. Two of the honorees were Gay Carroll, comptroller of Humble Oil & Refining Company, and William A. Baker, vice president and treasurer of Shell Pipeline Corporation.

California Conservation Men Elect Officers for 1951-52

Chester F. Dolley, president of Atlantic Oil Company, has been elected chairman of the Conservation Committee of California Oil Producers. The committee works on crude oil conservation problems in California, and has district committee members elected by vote of the oil producers to represent the state's 30 districts.

Other officers are M. T. Miller, Standard Oil Company of California, first vice chairman; J. L. Stephens, Chanslor-Canfield Midway Oil Company, second vice chairman; and L. W. Chasteen, Union Oil Company of California, secretary.

Engineering Fellowships Set At University of Oklahoma

Four fellowships for candidates for the master's degree in petroleum engineering are being made available at the University of Oklahoma by oil companis. The Shell Oil Company appointment will be for $1200, plus $300 for research equipment. The Sinclair Refining Company award is for $1500, with an additional $1000 for tuition, laboratory fees, etc. The Stanolind Oil and Gas Company stipend is $1250, plus $500 for miscellaneous expenses. Humble Oil & Refining Company has made available $1250, with $300 additional for expenses.

Pacific Coast Geophysicists Will Convene in Los Angeles

The Pacific Coast section, Society of Exploration Geophysicists, will hold its annual fall meeting on November 1 and 2 at the Ambassador Hotel in Los Angeles, it was announced today by Robert Dyk, of General Petroleum Corp., Bakersfield, president of the section. The meeting will again be held in conjunction with the annual sessions of the local AAPG and SEPM groups and coordinated programs will be presented. Flint Agee, of United Geophysical Company, Pasadena, and vice president of the Southern division of the Pacific Coast Section, will be in charge of program and arrangements for the SEG.

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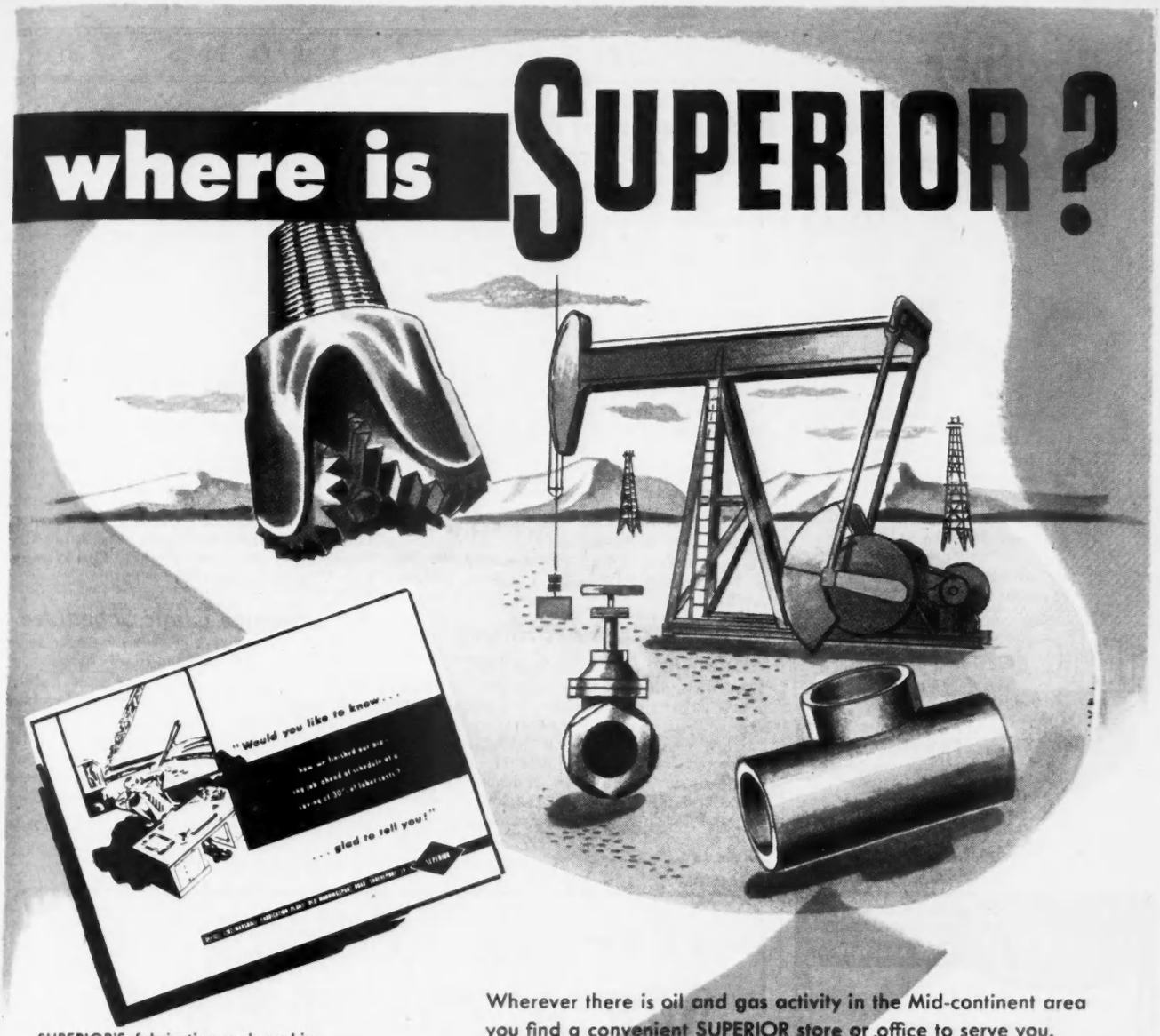

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ASSOCIATIONS

Dallas Purchasing Agents Group Elects R. E. F. Schmid President

R. E. F. Schmid, Continental Supply Company, was elected president of the Dallas Purchasing Agents Association. Schmid succeeds J. D. Brown, General American Oil Company.

Other officers include Frank Wodrich, General Instruments, Inc., first vice president; John Guynes, Magnolia Petroleum Company, second vice president, and Fred D. Bradley, Southern Union Gas Company, secretary-treasurer.

R. E. F. Schmid

Schmid, who has been with Continental Supply for 30 years, went to Dallas when his company moved its headquarters from St. Louis to Dallas in 1933.

Eastern District API Honors Production Men for Service

In recognition of distinguished service in API district activities, "Citation for Service" awards were conferred by the Eastern District Division of Production. Presented by J. C. Donnell II, API vice president for production and president of The Ohio Oil Company, the awards went to the following 18 men: Frank M. Brewster, Belmont Quadrangle Drilling Corporation, Bradford, Penn.; E. L. Estabrook, Morristown, N. J. (Standard Oil Company [N. J.], retired); J. French Robinson, East Ohio Gas Company, Cleveland; J. G. Montgomery, Jr., United Natural Gas Company, Oil City, Penn.; J. H. Newlon, Equitable Gas Company, Pittsburgh; H. H. Phillips, Phillips Drilling Corporation, San Antonio, Texas; J. C. Askam, The Ohio Oil Company, Findlay, Ohio; F. E. Eckert, Hanley & Bird, Bradford; Christy Payne, Jr., The Peoples Natural Gas Company, Pittsburgh; D. T. Ring, The Preston Oil Company, Columbus; J. J. Schmidt, East Ohio Gas, Cleveland; O. W. Van Petten, Columbian Carbon Company, Charleston, W. Va.; M. G. Gulley, Gulf Oil Corporation, Pittsburgh; W. E. Ferguson, The Ohio Fuel Gas Company, Columbus; V. F. Bowyer, Peoples Natural Gas, Pittsburgh; R. B. Anderson, Columbian Carbon, Charleston; J. V. Goodman, Equitable Gas, Pittsburgh; and S. M. Vockel, The Waverly Oil Works, Pittsburgh.

Maintenance Clinic Scheduled

One of the functions to be sponsored by the Instrument Society of America at its Sixth Annual Conference and Exhibit in Houston during September is a Mechanics Maintenance Clinic to be held just prior to the main conference. C. R. Miller, General Tire and Rubber Company, Baytown, is local chairman of the Instrument Mechanics Maintenance Clinic Committee.

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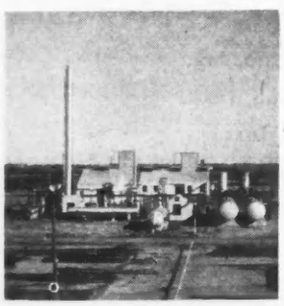

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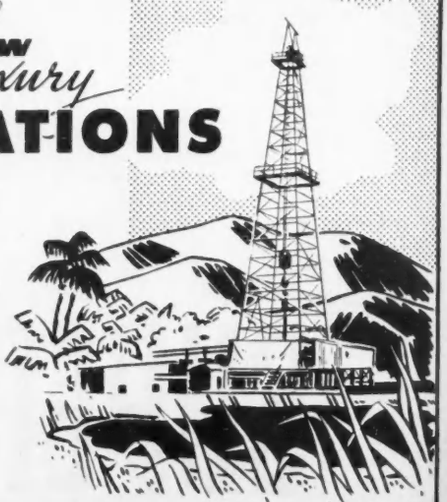

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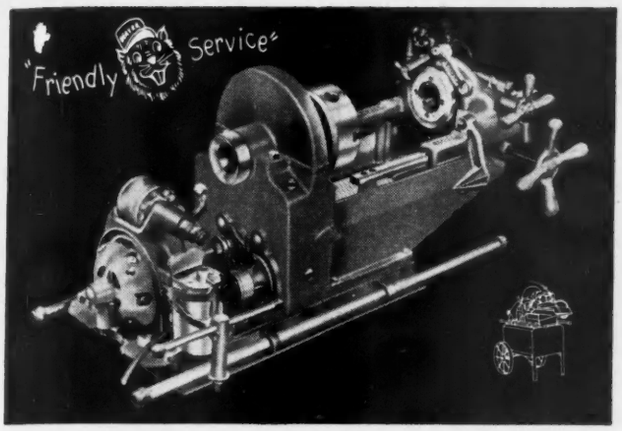

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EQUIPMENT AND SERVICE SUPPLIERS' NOTES

Schlumberger Announces Personnel Changes in U. S. and Foreign Areas

W. J. Gillingham has been appointed executive vice president of Schlumberger Well Surveying Corporation to succeed Roger Henquet, resigned. A. Claudet, who replaces Gillingham at Caracas, Venezuela, has been named vice president and general manager of the Schlumberger companies operating in South America.

A. Vennema has been promoted to vice president in charge of personnel relations.

Charles Doh has been transferred from Illinois to New Orleans to replace Claudet as manager of the Southeast area. Allen Morazzani has been promoted to manager of the Northeast area (Illinois, Kentucky, Michigan and Appalachian region), succeeding Doh.

Gillingham has been with the Schlumberger companies since 1934, and served as vice president and general manager of the Latin American Schlumberger companies from 1947 until his present appointment. Vennema has worked for Schlumberger since 1937. Claudet started with the French Company in 1930 and has worked in all parts of the world. Doh and Morazzani came to the U. S. in 1937 after service with Schlumberger in other parts of the world.

W. J. Gillingham

A. Claudet

Houston Bank & Trust Company Elects Two Local Oil Men as Board Members

Noble C. Ginther and Curtis Hankamer, Houston oil men, were named directors of the Houston Bank & Trust Company. Ginther, co-owner of Ginther, Warren and Ginther, Oil Properties, has been an active independent operator and producer in Houston for 18 years. Hankamer started his oil business in Houston in 1938 as an independent producer whose operation covers primarily the Texas-Louisiana Gulf Coast area.

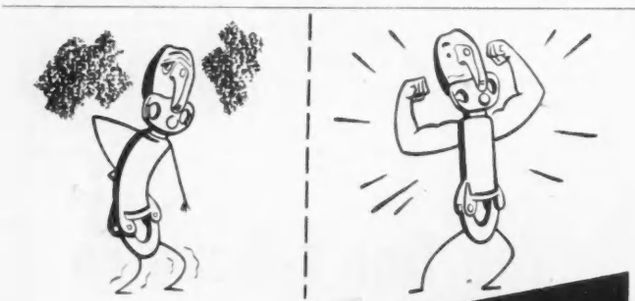
Phill Renn Joins Oil Base in Charge Of New Gulf Coast Office at Houston

Oil Base, Inc., has established a Gulf Coast office at Houston, with Phil Renn in charge. Renn was formerly with Cardinal Chemicals, Inc., in charge of the Gulf Coast area. Prior to this he was sales engineer for Baroid Sales Division for several years in the Gulf Coast area. He is a graduate in chemical engineering from the Rice Institute, and his varied drilling experience includes three years with Lago Petroleum Corporation in Venezuela.

Phil Renn

Welex Jet Opens Hobbs Station

Welex Jet Services, Inc., has opened a new field station at 110 South Grimes Street, Hobbs, N. M., with Ray H. Williams in charge. W. D. Smith has been promoted to assistant manager.



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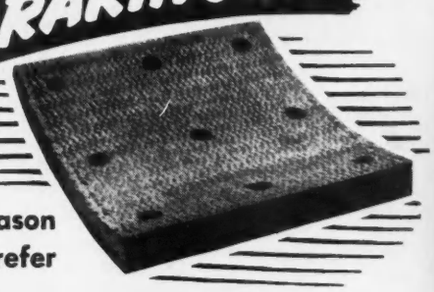

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EQUIPMENT AND SERVICE SUPPLIERS' NOTES

O. S. Petty

P. J. Rudolph

Petty Geophysical Engineering Elects Top Officers; Rudolph is President

For the first time in its 26-year history, Petty Geophysical Engineering Company has elected new officers and directors from outside the Petty family. P. J. Rudolph was named president and general manager, as O. Scott Petty was advanced to chairman of the board. Other officers are Weldon L. Crawford, executive vice president and treasurer; Van A. Petty, Jr., vice president and secretary; and W. Lee Moore, vice president.

W. L. Crawford

Directors are O. S. Petty, chairman, Dabney E. Petty, Van A. Petty, Jr., Rudolph, Crawford, Moore and Arthur L. Lay.

The same officers and directors will also serve Petty Laboratories, Inc., which builds Petty's equipment, and Petty Geophysical Company, which conducts the foreign operations.

Rudolph, who joined the companies in 1932, was most recently general manager. Crawford has been with Petty since 1933, and has served in foreign operations as well as in the U. S. He has been assistant general manager since 1944. Van Petty, son of one of the founders, has been a vice president of the companies since 1942. Moore joined the companies in 1930, and has supervised geophysical exploration in the U. S. and abroad.

W. Lee Moore

Van A. Petty, Jr.

Calgary Office is Established

The National Supply Company, Ltd., has established a department in Calgary, Alberta, to handle the sales accounting functions of the company in Canada. The operations had previously been conducted from Pittsburgh.

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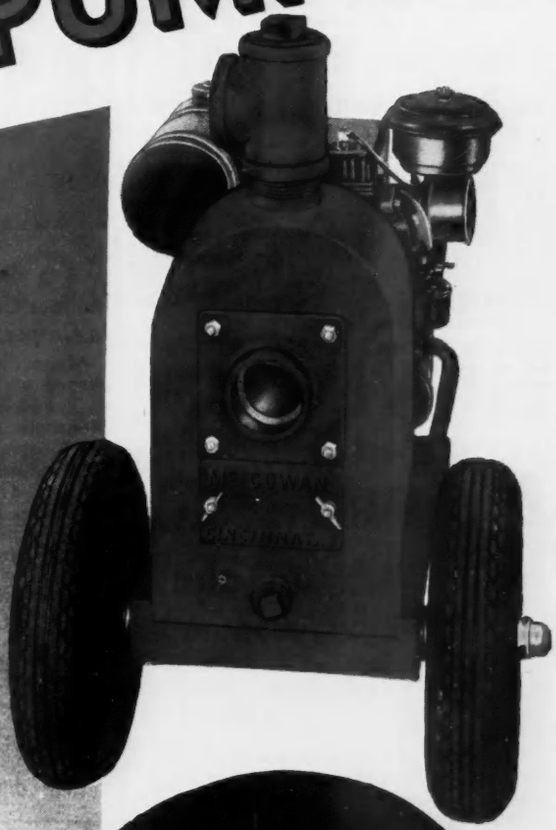

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Check these advantages

- **Protects your investment.**
- **Eliminates or reduces rig down time.**
- **Savings result from ability to screen.**
- **No detrimental effect on viscosity, water content and gel strength.**
- **Easily added to mud.**
- **Does not interfere with coring operations.**

Available through leading mud service companies.

GLC

STRATA-CRETE SALES
GREAT LAKES CARBON CORPORATION
5845 Atlantic Ave., Long Beach 5, Calif.
Sales Offices in Principal Oil Centers

EQUIPMENT and SERVICE SUPPLIERS' NOTES

West Coast Engine and Equipment Company's new building in Albany, Calif., is pictured in this artist's sketch. The company, which recently moved into its new quarters, is distributor for General Motors diesel engines in the petroleum, industrial, marine and construction fields of northern California.

C. W. Clark, Jr.

Joe T. Webster

Magnet Cove Barium Opens Office In Casper; Appoints Division Manager

Magnet Cove Barium Corporation has opened a district office in Casper, Wyo., to serve the Rocky Mountain region. C. W. Clark, Jr., has been appointed manager of the Rocky Mountain division and will have headquarters at 140 East Midwest Avenue in Casper.

Other appointments announced by the company are those of Joe T. Webster, as manager of the Texas Gulf Coast division, Houston; and James H. McLaurin, manager of the Southeastern division, with offices in the Canal Building, New Orleans.

James H. McLaurin

Evans Succeeds Prosser as Manager Of Emsco's D+B Plant at Garland

L. G. (Les) Evans has been appointed manager of the Garland, Texas, plant of the D+B Division, Emsco Derrick & Equipment Company. He succeeds Frank L. Prosser, retired, who, as Mid-Continent manager also served as plant manager at Garland.

L. G. Evans

Prosser, who had 28 years' experience in the oil industry, joined the D+B Division in 1936. He had previously been with Shell Oil Company.

Evans has been with the division since 1940, except for three years during World War II, when he was in the Navy. He has recently been chief engineer at Garland.

Promotions and Transfers Announced By National Geophysical Company

R. L. Boulware, formerly party chief, and J. H. Frazer have been promoted to supervisors for National Geophysical Company, of Canada, Ltd. Corby Hart was transferred from Canada and promoted to supervisor of National Geophysical Company, Dallas.

E. L. Campbell was promoted to supervisor in charge of West Texas operations.

Specify **PELCO** Welding Saddles

PELICAN WELL TOOL & SUPPLY CO.

P. O. Drawer 1108
Shreveport (84), La.

SEE YOUR NEAREST SUPPLY HOUSE

A.P.I. COUPLINGS FOR OIL FIELD USE

EVERY SIZE AND TYPE FROM *ONE* SOURCE

LINE PIPE COUPLINGS A.P.I.
1/8" to 12"—Seamless and Special Processed—Black or Galvanized

PLAIN TUBING COUPLINGS A.P.I.
1" to 3"—Seamless

EXTERNAL UPSET TUBING COUPLINGS A.P.I.
3/4" to 3 1/2"—Seamless

CASING COUPLINGS A.P.I.
4 1/2" to 13 3/8"—Long or Short

HYDRAULIC COUPLINGS
1/8" to 3"—Seamless

REAMED AND DRIFTED A.I.S.I.
3/4" to 12"—Seamless or Spl. Processed

DRIVE PIPE COUPLINGS
3/8" to 12"—Seamless or Spl. Processed

Consult Our Nearest Quick Service Sales Office:

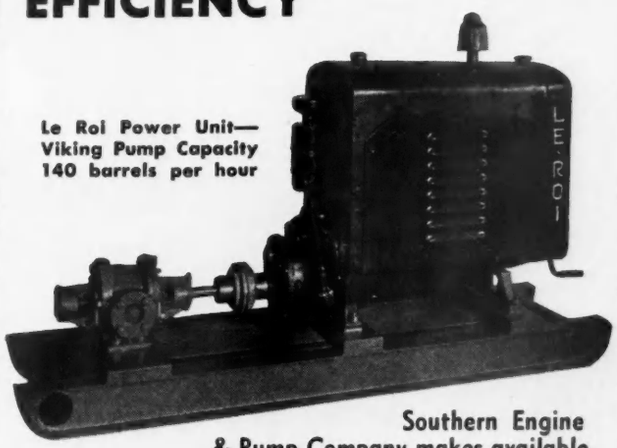
Albany, N. Y.—Albert L. Becker, 434 Clinton Ave.
Baltimore—Ted Barto, 2301 N. Charles St
Boston—Wm. F. Bennett, 24 Spring St., Somerville
Buffalo—W. E. Spencer & Assoc's, 241 S. Elmwood Ave
Chicago—Harry A. Jay, 122 So. Michigan Ave.
Denver—Earl H. Jones & Co., 1863 Wazee St
Detroit—Thomas L. Osberger, 19451 Livernois Ave
Erie, Pa.—R. J. Maggi, Box 711
Houston—Henry H. Paris Distributor, Inc., Box 932
Kansas City, Mo.—Wm. J. Hebenstreit, 3122 Coleman Rd.
Los Angeles—James A. Riordan Co., 1400 Santa Fe Ave.
Minneapolis—Lin J. Krause, 200 Lumber Exchange
Newark, N.J.—Murray Eskin, Industrial Office Bldg.
New York—Henry Stein, 50 Cliff St.
Philadelphia—J. W. Worthington, 401 N. Broad St.
Portland, Ore.—Earl H. Jones & Co., 1233 NW 12th Ave.
Richmond, Va.—P. C. Abbott & Co., Mutual Bldg.
San Francisco—Earl H. Jones & Co., 1150 Folsom St.
Seattle—Earl H. Jones & Co., 619 Second Ave.

FACTORY 'PHONE: WOODSDALE 3296

WHEELING MACHINE PRODUCTS COMPANY

ELM GROVE STATION — WHEELING, W. VA.

THE RIGHT TEAM FOR EFFICIENCY



Le Roi Power Unit—Viking Pump Capacity 140 barrels per hour

Southern Engine & Pump Company makes available to you 40 years of "KNOW HOW" in your pumping requirements.

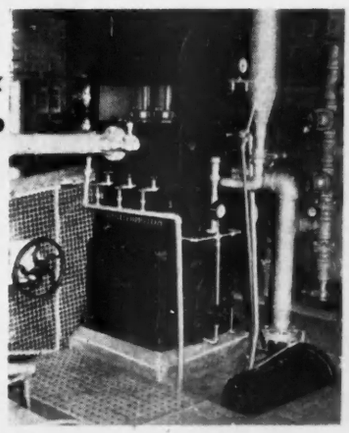
- Complete units and replacement parts at all branches.

SOUTHERN ENGINE & PUMP COMPANY

MANUFACTURERS • MACHINERY FACTORS • CONTRACTORS
Houston - Dallas - Kilgore - San Antonio - Edinburg
Corpus Christi, Texas · Houma and Lafayette, La.

WATER FLOODING TYPE VTE

WORTHINGTON
Vertical Triplex
PLUNGER PUMP



Capacities up to 5,000 B/D

Pressures up to 10,000 P.S.I.

DRIVE: Electric Motor or Engine

FEATURES: Pump has no gears
Totally-enclosed Power End
Pressure Oiling System

Plungers on top; patented stuffing boxes; completely accessible; roller bearings; no adjustment necessary; dry joint between liquid end and power end; no leakage into power end. Heat-treated stainless steel valve service; long lift; minimum maintenance; metal-to-metal joints on all valve plugs; no gaskets to blow; constant speed; constant capacity.

A. M. LOCKETT & COMPANY, LTD.

NEW ORLEANS — HOUSTON — DALLAS

At the Annual General Sales Meeting.

Stewart & Stevenson Services sales and factory representatives from branches throughout Texas gathered in Houston for an all-day session and inspection of expanded plant facilities at the company sales and manufacturing headquarters. Joe Manning, vice president and general manager of Stewart & Stevenson Services, conducted the meeting. In attendance were, left to right, standing, Benny Miller, Fred Malley, Bob Hardy, Bob McMullen, Emmett Dobbs, Harvey Trotter, Paul Driver, Bill Collett, Jim Brown, King Boyd, Bill Foster, Tiny Herman, Slim Childress, Tommy Langham, W. L. Rutledge, Lee Howell, Harold Speers, N. N. Elkins; seated, Dick Grant, Dick Conolly, Manning, D. D. Chene and Loy Leffingwell.

O-C-T "PC" CHOKES WERE DESIGNED SPECIFICALLY TO GET THE JOB DONE AT EXTREME PRESSURES

This O-C-T Choke was actually designed for trouble-free, long-life 15,000 and 20,000 lb. service. It provides speed because bean replacement is accomplished simply by removing a hand tight cap. Besides, it provides flexibility, strength and durability. Ask your O-C-T Representative or write for details on this dependable high pressure choke. Available through your supply store.

Oil Center Tool Co.

P. O. Box 3091, Houston, Texas

Schlumberger Executive Resigns; Establishes Offices in Houston

Roger Henquet, executive vice president of Schlumberger Well Surveying Corporation, Houston, has resigned and has opened a business office at 1725 Commerce Building, Houston.

Roger Henquet

Henquet, who had been with the Schlumberger organization for 22 years, was one of the original group of young French engineers who helped build the corporation from a small geophysical unit into a worldwide organization. His plans for the future have not been announced.

Cummins Sales & Service Establishes New Southwest Diesel Service Shops

Cummins Sales & Service, Inc., has opened its eleventh Southwest diesel service shop at Pharr, Texas, to serve the Rio Grande Valley area. In addition to a display room and offices, the building contains complete parts room and service area and a large truck porte.

District service manager is R. G. Barnes, former sales engineer at New Orleans. Otis E. Farley, who was transferred from the same position at Shreveport, is store manager at Pharr. V. J. Mickell, from Houston, W. F. Wade, from Great Bend, Kansas, and Troy L. Weaver are mechanics.

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

General Sales Manager Is Elected To Lane-Wells Board Membership

Jas. D. Hughes, general sales manager of Lane-Wells Company, has been elected a director of the company. He has been with Lane-Wells since 1939 and was Gulf Coast division sales manager in Houston from 1941 to 1945. He then transferred to Los Angeles as manager of oil field sales. Early in 1945 he was made sales manager and in 1950 was made general sales manager.

Jas. D. Hughes

General Geophysical Company Names Three-State Area Superintendent

Dave C. Garrett, former toolpusher for General Geophysical Company drilling operations in Indiana, Illinois and Kentucky, has been named district superintendent for the company's operations in the three-state area. Garrett succeeds Paul A. Whitney.

Headquarters for the company's operations in this area have been moved from Mt. Vernon, Ill., to 203 Indiana Bank Building, Evansville, Ind.

Dave C. Garrett

Toolpushers for General Geophysical drilling operations in the area are R. N. (Nick) Minear and K. P. (Kenny) Clark.

Black, Sivalls & Bryson Advances Simms to Welding Development Post

Howard N. Simms has been appointed director of welding development and quality control for Black, Sivalls & Bryson, Inc. Simms will be responsible for the supervision of welding methods and procedures and the establishment and maintenance of quality control of all welded products.

Howard N. Simms

Simms, who has been with Black, Sivalls & Bryson since 1936, is a director of the American Welding Society.

Cooper-Bessemer Corporation Adds To Field Sales-Engineering Staff

Grant C. Woodard has joined the field sales and engineering staff of The Cooper-Bessemer Corporation, and will directly assist C. J. Michelson in Michigan, Ohio, West Virginia, Kentucky and Tennessee. Woodard has been undergoing sales engineering training for several years at Cooper-Bessemer's Mt. Vernon, Ohio, plant. He is a graduate of Cornell University with a B.S. degree in administrative engineering.

1895 **1st of Tulsa** 1951

STATEMENT OF CONDITION

June 30, 1951

RESOURCES

Cash and Due from Banks	$50,308,506.76	
U. S. Government Securities	72,743,725.51	$123,052,232.27
Other Bonds and Securities		10,934,508.08
Loans and Discounts		68,504,527.97
Federal Reserve Bank Stock		300,000.00
Income Earned, Not Collected		736,172.40
Bank Premises		1.00
Furniture and Fixtures		745,603.44
Customers' Liability Under Letters of Credit		8,036,623.49
Other Resources		16,237.11
		$212,325,905.76

LIABILITIES

Deposits		$190,332,135.14
Income Collected, Not Earned		331,787.22
Taxes, Interest and Expense—Accrued		623,908.65
Letters of Credit Outstanding		8,036,623.49
Capital	$4,000,000.00	
Surplus	6,000,000.00	
Undivided Profits	3,001,451.26	13,001,451.26
		$212,325,905.76

DIRECTORS

J. P. BYRD, JR.
Senior Vice President

F. L. DUNN
Chairman of the Board

A. L. FARMER
Real Estate

RUSH GREENSLADE
Investments

ELMER HALE
President, Hale-Halsell Company

R. K. LANE
President, Public Service Company of Oklahoma

JOHN E. MABEE
Investments

JOHN D. MAYO
President, Mayo Hotel Co. and Mayos' Inc.

FRANK G. McCLINTOCK
Vice President, Zephyr Petroleum Company

R. OTIS McCLINTOCK
President

E. H. McCOLLOUGH
Vice President, Amerada Petroleum Corporation

F. B. PARRIOTT
Chairman, Sunray Oil Corporation

FRANK O. PRIOR
Executive Vice President, Standard Oil Co. (Ind.)

J. L. SHAKELY
President, Jones & Laughlin Supply Company

W. G. SKELLY
President, Skelly Oil Company

R. ELMO THOMPSON
Senior Vice President

GARY Y. VANDEVER
President, Vandever Dry Goods Company

JAY P. WALKER
President, National Tank Company

W. K. WARREN
President, Warren Petroleum Corporation

JOHN M. WINTERS, JR.
Conner, Winters, Lee and Randolph

THE FIRST NATIONAL BANK AND TRUST COMPANY OF TULSA

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Catawissa PERFECT SEAL Unions

HOT FORGED from solid, rectangular steel bars, designed and produced for dependable, long-life service under the severest piping conditions!

A TYPE FOR EVERY USE!
FOR ALL PRESSURES!
FOR ALL TEMPERATURES!

Standard & Double Extra Heavy UNIONS

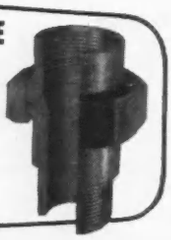
Available with screwed or socket weld ends. 3000-lb. sizes 1/8" to 3"; 6000-lb. sizes 1/8" to 2".

ORIFICE UNIONS

With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

MALE & FEMALE UNIONS

With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.



Standard & Double Extra Heavy LUG NUT UNIONS

Hammer-type for quick opening and quick closing.

Stocked and Distributed by
OIL WELL SUPPLY CO.
Branches Serving All Oil Fields

CATAWISSA VALVE AND FITTINGS COMPANY
60 Mill St. • CATAWISSA, PA.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Worthington Pump and Machinery Corporation has begun construction of this new vertical turbine pump plant at Succasunna, N. J. The one-story plant will manufacture pumps for customers east of the Mississippi River and abroad.

Oil Well Supply Company Announces Personnel Changes in Three Areas

Harris W. Quaite has been named division office manager of Oil Well Supply Company's Gulf Coast division headquarters office at Houston. Quaite, who was formerly at Wichita Falls, Texas, succeeds R. R. George, division office manager since February, 1949, who has transferred to Calgary, Alberta, Canada.

Donald F. Greenlaw, formerly manager of the Victoria, Texas, store, is transferred to Alice, Texas, as assistant to district merchandise manager. He is succeeded by Edward D. Haas, manager of the Mirando City, Texas, store. The new manager of the Mirando City store is Joseph P. Higgins, field representative at Freer, Texas, for the past year. Rush L. Johnson, storeman at Alice, has been promoted to field representative at that city.

G. R. Emerick has retired after more than 35 years with the company and has been succeeded as manager of the East Texas, North Louisiana and Arkansas district by P. A. Kennon.

Carl F. Fischer, assistant manager of the Chicago office, Eastern division, succeeds Kennon as manager of that office.

Two Advanced in Pipe Sales

Paul B. Baird of Youngstown has been advanced to manager of standard pipe sales for The Youngstown Sheet and Tube Company, Youngstown, Ohio. He succeeds Glenn W. Christopher who died recently. Carl T. Selander of Chicago, western representative for standard pipe products for the last year, has been promoted to assistant manager of standard pipe sales with headquarters in Chicago.

Sterling Packing & Gasket Elects Vice President and General Manager

Carl Fenity has been elected vice president and general manager of Sterling Packing and Gasket Company, Inc., Houston. Fenity joined the Sterling sales organization in 1946, and was soon made assistant sales manager. He was most recently sales manager. A graduate of Rice Institute, Fenity served five years with the Navy, and completed duty as a lieutenant commander.

Carl Fenity

Personnel Specialist Joins M & R To Assist in Management Operation

A. A. Nance, foreign employe relations advisor of Standard Oil Company (N.J.), New York, has resigned to join M & R Specialty Company, Houston, to assist M. (Bink) Manning in the management and operation of the company.

Nance, a 1931 graduate of Texas A. & M. College, was with Humble Oil & Refining Company in engineering and industrial relations positions from 1933 until 1942, when he joined the Navy. On release from service he rejoined Humble, and in 1947 was loaned to Middle East Pipe Line Company to work in New York, London, Baghdad, Beirut and Abadan until 1948. He was assistant personnel manager until he left in February, 1949, to join Jersey Standard as foreign employe relations advisor.

Completely Air Conditioned **4 CONVENIENT LOCATIONS**

LOMA ALTO HOTEL — **4518 LEMMON AVE.**
LAWN HOTEL — **3718 LEMMON AVE.**
LAKEWOOD HOTEL — **1818 ABRAMS RD.**
LYNN HOTEL — **3405 GASTON AVE.**

DALLAS, TEXAS

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

Boarding the Plane as they leave on a European business and pleasure trip are John and Susan Merritt. Merritt is general manager of the Patterson-Ballagh Division of Byron Jackson Company. Their first stop was the PESA convention in Quebec, and from there they flew to London and the Continent, where Merritt is conferring with British and French manufacturers who are licensees of Byron Jackson Company.

Well Equipment Corporation Names Jordan as Assistant Sales Manager

Foster A. Jordan has been appointed assistant sales manager of Well Equipment Manufacturing Corporation, Houston.

F. A. Jordan

For the past year Jordan has been representative in the West Texas-New Mexico district. He has been with Weco six years, serving in Gulf Coast, North Louisiana, and Central Texas before moving to West Texas.

J. C. McCelvey and L. L. Durkin have been transferred to the West Texas-New Mexico territory as Weco Representatives.

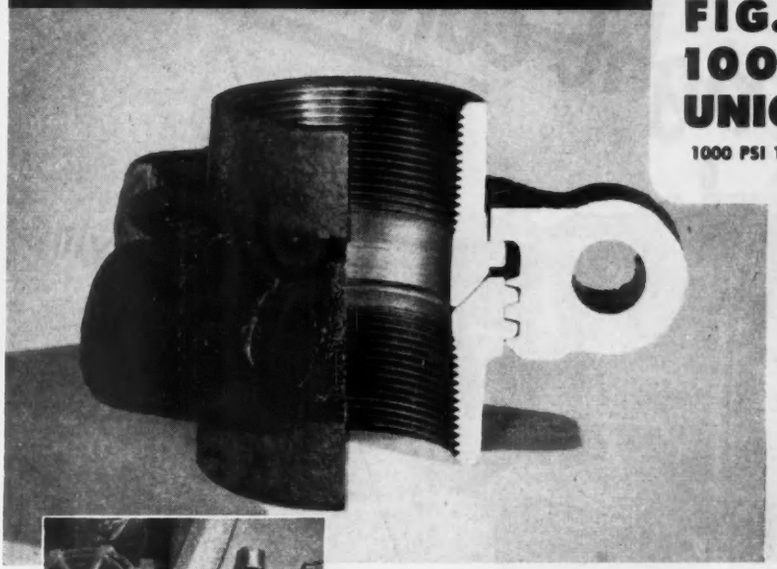
British Firm Begins Manufacture Of McEvoy Valves for Oil Industry

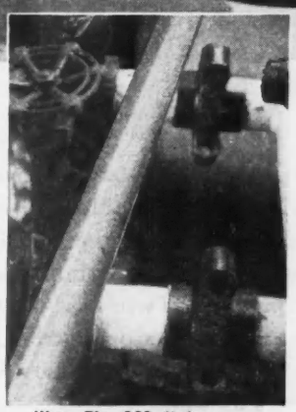
Under an agreement reached more than a year ago, the British manufacturing firm of Newman, Hender & Company, Ltd., Woodchester, England, has begun production of an English version of the McEvoy Gate valve, to be called the "Newman-McEvoy" valve. The McEvoy Company, Houston, issued the license to enable Newman, Hender to manufacture and distribute the valves for the oil production industry in sterling bloc markets.

Willard O. Hedrick, vice president in charge of production for the McEvoy Company, went to England to discuss engineering and production details of the valves.

EXACTLY RIGHT FOR THE JOB!

WECO FIG. 100 UNION
1000 PSI TEST





Weco Fig. 100 Unions are exactly right for connecting steel mud tanks.

Fig. 100 Unions are exactly right for fuel line connections.

Exactly right for simplifying valve installation maintenance.

MEANS 100% EFFICIENCY in Make-up, Service, Economy

Designed for 1000 lb. test pressures, Weco Fig. 100 Unions are exactly right for separator and tank connections, fuel and water lines, manifolds, headers and other connections on lines with working pressures of approximately 500 lbs.

The ball and cone seat makes a positive, leak-proof seal. Fig. 100 Unions are made of tough and durable malleable iron . . . withstand repeated use in hard service. You can make them up fast with a hammer blow on the bar nut lugs, or with a bar through the holes in the nut.

For longest service and greatest economy on low pressure line connections use the Union that is exactly right for the job . . . WECO FIG. 100 UNION. Available in sizes 2" through 8".

WELL EQUIPMENT MFG. CORP.
Subsidiary of Chiksan Company
HOUSTON 1, TEXAS
Exclusive Sales Representative Outside Mid-Continent Area
CHIKSAN COMPANY
Brea, Calif. Chicago 3, Ill. Newark 2, N. J.
Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. Newark 2, N. J.

WECO
Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

always the right connection

between driving and driven units . . .

Wherever you find horsepower at work, you will find Twin Disc Clutches and Hydraulic Drives.

That's because Twin Disc offers *standard* units for every kind of application in the industrial field, from split-second work cycle operations to 1000 hp tugs-of-war between prime movers and mother nature.

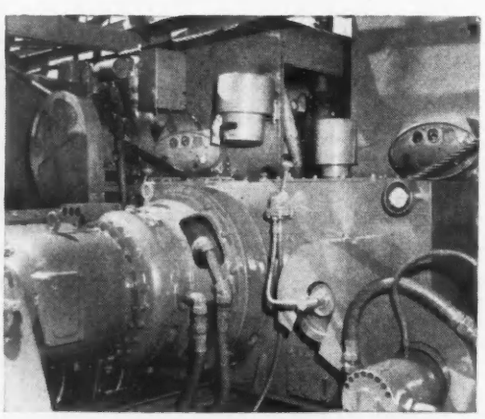
Thirty-three years of working with hundreds of leading equipment manufacturers have proved that, no matter the problem, Twin Disc can help provide the answer.

And an answer that is impartial, for not only does Twin Disc offer a complete line of friction clutches, it offers a complete line of industrial fluid drives as well.

That's why for the *right connection between driving and driven units,* always specify Twin Disc.

for example

Twin Disc Hydraulic Torque Converters are available for any make of engine commonly employed in the oil fields. This unit is employed on an Ideco rig on which two engines drive through a single converter. Twin Disc is the only Hydraulic Torque Converter which multiplies torque as much as five times . . . is the only converter available in a complete range of models to handle from 40 to 1,000 hp.



TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U. S. PAT. OFF.

Clutches & Hydraulic Drives

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

BRANCHES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • SEATTLE • TULSA

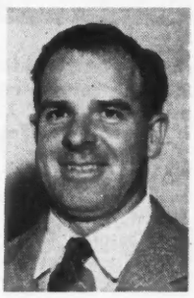
EQUIPMENT AND SERVICE SUPPLIERS' NOTES

W. M. Hays

Ed W. Plaugher

Plaugher & Associates Will Handle Kelley Safety Products in California

Ben F. Kelley Company, Inc., manufacturer of oil field safety equipment, has named Ed W. Plaugher & Associates representatives in California. Other members of the Plaugher firm are Wallace M. Hays, formerly with Mercury Oil Tool Company, and George Winterburn, formerly with Signal Oil and Gas Company as equipment expediter, and later with Oil Well Manufacturing Corporation as salesman.



George Winterburn

Plaugher's 30 years in the oil business have included work on drilling rigs. He started selling oil field equipment in 1930, and worked for three years in foreign fields.

Lucey Re-Establishes Pipe Exchange As Service to Petroleum Industry

A non-profit Pipe Exchange Service, first inaugurated in 1947, has been re-established by Lucey Products Corporation, Tulsa. The Lucey firm obtains listings from oil operators who have tubular goods of certain sizes, weights and grades which would be impractical to use in a particular operation. By referring to a work sheet of other listings, the company is able to assist operators in disposing of casing, tubing and line pipe they don't need—and obtaining what they do need. After the operators are referred to each other, they work out their own trades.

Dowell Incorporated Offices Are Moved into New Quarters in Tulsa

Several departments of Dowell Incorporated have moved into a new office building at 1150 North Utica Avenue, Tulsa. Also at the Utica address are Dowell Truck, Magnesium Anode and Chemical Manufacturing plants, the Warehouse and the Engineering Research Laboratories.

The Purchasing, Accounting, Auditing, Engineering and Maintenance departments, formerly located on the Fifth floor of the Kennedy building, are now in the new office building. All present space in the Kennedy building will be maintained for Operations, Sales, Service and Product Development and Stenographic departments.

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

Executive Promotions Are Announced By Aetna Ball and Roller Bearing

J. J. Rozner, formerly chief engineer and works manager, has been elected vice president in charge of operations of the Aetna Ball and Roller Bearing Company, Chicago. J. E. Dillon, metallurgist, was appointed to replace Rozner as chief engineer, and the position of works manager was dropped from the executive roster. C. E. Poehler was appointed as assistant to H. V. Fox, plant superintendent.

J. J. Rozner

Rozner joined Aetna's Engineering department in 1928. In 1934 he was appointed metallurgist, and a few months later assistant chief engineer. He became chief engineer in 1940, and took over the added duties of works manager in 1948.

Dresser Reorganizes Ideco and Kobe Management; Establishes New Firm

Completion of the formation of a new organization known as Dresser Equipment Company was announced by Dresser Industries, Inc., Dallas.

The new company is composed of two former Dresser Industries' subsidiaries, Kobe, Inc., developers and manufacturers of Kobe hydraulic pumping equipment, and International Derrick & Equipment Company, manufacturers of drilling and production equipment. These two organizations will function as the Kobe Division and Ideco Division of Dresser Equipment Company, itself an operating subsidiary of Dresser Industries, Inc.

Kobe will be a complete operating unit. Ideco will operate its three manufacturing plants at Columbus, Ohio, Beaumont, Texas, and Torrance, Calif., as separate units under their own general managers. These Ideco general managers will have complete charge of each individual plant's administration and will report directly to John B. O'Connor, who has been elected president of Dresser Equipment Company, in addition to being executive vice president of Dresser Industries, Inc.

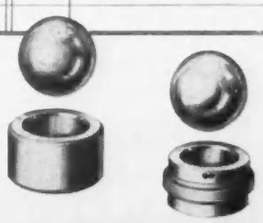
Contracting and Engineering Firms Conduct Short Course on Welding

Houston Contracting Company, in cooperation with Industrial X-Ray Engineers, has completed a short course in X-Ray interpretation of pipe line welding at its Houston warehouse. The course consisted of lectures and welding and inspection covering all standards of pipe line welding quality.

Representing Industrial X-Ray Engineers were J. W. Watt, W. J. Parker and Andy Jordheim. Welding foremen and key welders attending for Houston Contracting Company were Jack Slovack, Lewis Young, A. E. Benham, R. R. Rice, S. A. Corkern, Dick Moore, E. D. Singleton, J. A. Vaught, and W. H. Brocksmith.

by Pacific PUMPS INC.

	QUESTION		ANSWER
Q	Why is oil at the bottom of the well like money in a safe deposit box?	A	Because it is a LIQUID ASSET IN DEAD STORAGE WITHOUT EARNING POWER.
Q	Can this condition be changed?	A	Yes — both can be activated and given earning power.
Q	How can they be activated?	A	Draw some of the money from the safe deposit box — purchase and install a Pacific Oil Well Plunger Pump in the well — pump the oil to the surface. MONEY IN CIRCULATION — OIL IN CIRCULATION — BOTH WITH POWER TO EARN.
Q	Why purchase and install Pacific Oil Well Plunger Pumps?	A	Because only Pacific gives you the EXCLUSIVE MOLOY® LINERS with the strength, toughness, hardness, combined with greater resistance to temperature, corrosion and abrasion essential for long, economical life.



Plungers — Chrome-Plated then Pacilited for extra wear life.
Valves and Seats — To fit well conditions.
Extra Heavy Seats — Resist hammering of ball with less chance of distortion.

PACIFIC *Precision Built* PUMPS

DW-6

Pacific Pumps inc.
ONE OF THE DRESSER INDUSTRIES

HUNTINGTON PARK, CALIFORNIA
Export Office: Chanin Bldg., 122 E. 42nd St., New York
Offices in All Principal Cities

KINZBACH
Automatic Mud Relief Valve

AT last positive automatic relief of overload pressures in mud lines is possible. The new Kinzbach Model 112 Relief Valve provides safer, more efficient pump or pressure relief and greater flexibility in operations than any other valve.

The Model 112 operates on working pressures from 750 to 2500 p.s.i. It Snaps Open for instantaneous pressure relief at maximum volume. It Snaps Shut to restore circulation instantly and automatically after a pre-determined pressure drop.

The Model 112 Valve can be used for any mud relief application, including compounding operations. Field tests prove conclusively that the Kinzbach Valve offers every operational advantage required for efficient mud operations. Write for full technical data. Ask for bulletin 11250.

KINZBACH TOOL CO., INC.
P. O. Box 277 • Houston 1, Texas

KINZBACH TOOL CO INC

Export Office:
74 Trinity Place,
New York, N. Y.

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

A. O. Smith Corporation Appoints Executives at Houston and Kankakee

C. R. Rigby, who was a group executive at the Milwaukee headquarters of A. O. Smith Corporation was named group executive in charge of the company's plant at Houston. The Houston Works manufactures pressure vessels, liquefied petroleum gas systems and vertical turbine pumps.

C. R. Rigby

F. S. Cornell

F. B. Dunn, former manager of the Houston Works, was placed in charge of personnel for both the Houston Works and the company's entire southwest district administrative area, which covers eight southwestern states.

F. S. Cornell, manager of A. O. Smith's plant at Kankakee, Ill., was appointed group executive for the Kankakee Works, the Eastern Motor division at Tipp City, Ohio, and the company's Heating division in Toledo, Ohio.

Dallas Agent Will Represent Carter in Mid-Continent Area

Blaine Johnston, 3521 Westminister Aveune, Dallas, has been named Mid-Continent distributor for S. C. Carter Company of Los Angeles, manufacturers of Salentine Varicycle hydraulic pumping units. Johnston will operate under the name of S. C. Carter Varicycle Sales Company.

Blaine Johnston

Johnston was formerly with International Derrick and Equipment Company as derrick service representative; general manager for Johnston Hydraulic Rig Company, Longview, Texas; and sales manager for L. R. Ward Company, Dallas. He received a degree in mechanical engineering from the University of Southern California and also attended Southern Methodist University.

Diesel Factory Under Construction

Construction has started on a new factory and office building in Crystal Lake, Ill., to house the Diesel division of Harnischfeger Corporation. The factory, along with a smaller office structure, will occupy approximately 100,000 square feet on an 80-acre site on South Main Street. Production of diesel engines is slated to start October 1.

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

McCollum and Ferris Organize New Seismographic Prospecting Concern

E. V. McCollum and Craig Ferris, geophysicists and exploration specialists, have formed GeoSeis, Inc., Tulsa. They are now associated with E. V. McCollum and Company, which firm will be closely associated with the new company. Their service in the field of seismographic prospecting will cover the U. S. and Canada. Field crews are already working in some areas.

Both McCollum and Ferris have been active in association work for many years.

E. V. McCollum

Craig Ferris

Both are members of the Society of Exploration Geophysicists, American Geophysical Union and the American Physical Society. McCollum is a member of the Seismographical Society of America and in 1948-9 served as secretary-treasurer of the Society of Exploration Geophysicists.

McCollum got his A. B. degree in 1925 and his M. S. degree in 1926 from the University of Oklahoma and was with Marland Oil Company until 1929, when he became control geophysicist of Continental Oil Company. In 1939, he joined Mott-Smith Corporation at Houston as chief geophysicist. In 1943, he formed E. V. McCollum and Company of Tulsa, gravity and magnetic contractors. Ferris got his A. B. degree at Friends University in Wichita in 1934, and did graduate work at the University of Oklahoma in 1935-6. He was with Mott-Smith from 1938 until he joined McCollum in 1943.

National Tube Appoints Beattie Superintendent of Fairless Works

Appointment of Thomas C. Beattie as general superintendent of Fairless Works of National Tube Company was announced. Beattie will manage all operations of the new pipe mills which are being installed by National Tube Company near Morrisville, Pa.

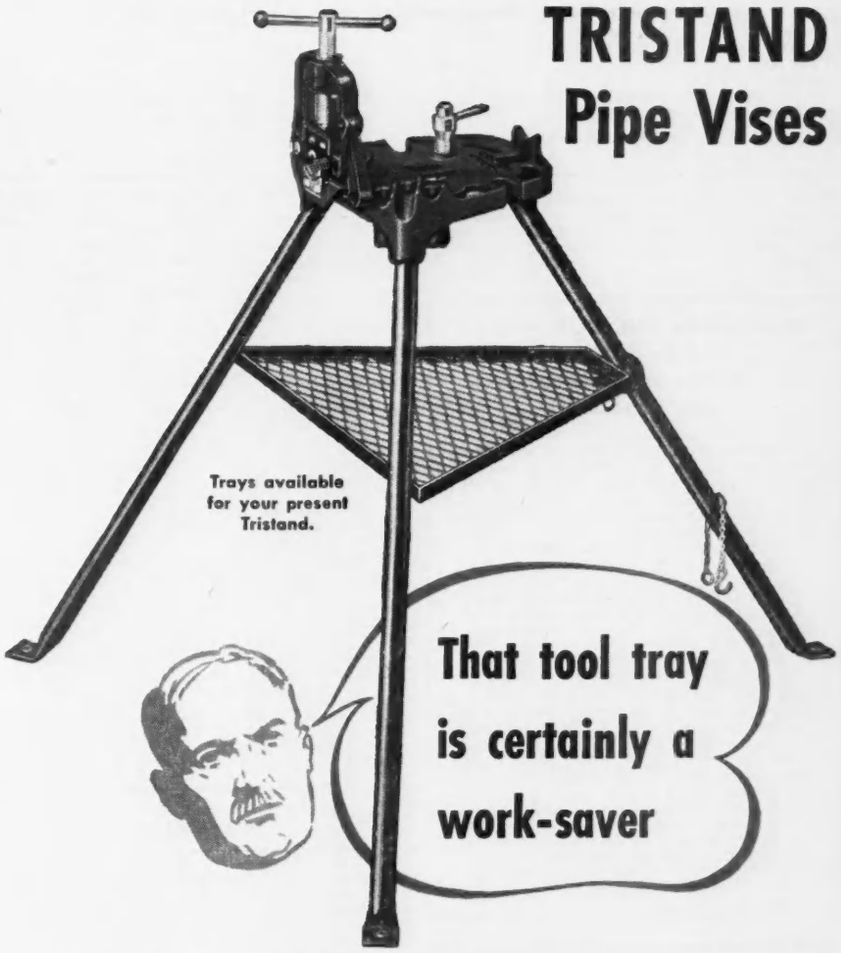
Beattie began his career in the engineering department of the Riverside Works of National Tube Company, eventually becoming superintendent of the pipe mills there. In 1927, he was transferred to Pittsburgh as an experimental engineer. In 1936, he was transferred to National Works of National Tube Company, as assistant superintendent of the butt mills, and later became division superintendent of the plant in charge of all pipe mills, finishing and shipping.

Bethlehem Supply Adds Engineer

Mark Yorston has joined the staff of Bethlehem Supply Company, Los Angeles, as sales engineer. He was formerly with J. B. Gill Company, constructors and engineers of Long Beach.

Handy work bench is a Bonus!

WITH RIGID TRISTAND Pipe Vises



• It's right there when you need it—the handy workbench built into every Tristand. New tray keeps tools at your fingertips—less stooping, easier work. Tray makes Tristand rigid—won't fold up in use. Legs have rubber feet to prevent travel. LonGrip tool-steel jaws won't slip, won't mar polished pipe and tubing. Yoke vise, 2½" capacity; chain vise, 4". Buy these new work-saver RIGID Tristands at your Supply House.

RIGID

★ Work-Saver Pipe Tools ★

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WORLD OIL'S Trading Post

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SERVICES · PERSONNEL · USED EQUIPMENT

RATES: Regular Classified (undisplayed) set in this size type: 10 cents per word. If Box Number is to be used count an additional six words. Replies forwarded without charge. Situation Wanted: 5 cents per word. Display advertisements, set in suitably larger type with ruled border: $9.00 per column inch per insertion. Situation Wanted: $4.50 per column inch. **All classified ads payable in advance.** 10% Discount if 3 or more insertions are ordered at one time. **COPY DEADLINE:** 5th of month preceding date of issue. Send copy and checks to: Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.

FOR SALE

We have the following electric motors in stock for immediate delivery

Size	Phase	Speed	Class
1 HP	1 or 3	1750	Explosion or Splash proof
1½ HP	3	1140	Splash proof
2 HP	3	1750	Splash proof
3 HP	1 or 3	1750	Explosion or Splash proof
5 HP	1 or 3	1750	Explosion or Splash proof

Lubbock Machine Co., Inc. Box 1138, Lubbock, Texas.
Telephone 4631.

■ Well drills, spudders, rotaries, core-drills. All sizes new and used equipment. Tools, drill pipe, cable, pipe. Fishing tools rented. Everything for well drilling. Pressey & Son, Pueblo, Colorado.

NATIONAL OIL COMPANY OF IRAN
Notice of Sale of Oil Products

In accordance with Article Seven (7) of the law regulating the nationalization of the oil industry in Iran, all purchasers of petroleum products from Iran for export are hereby notified that they can within one month from the date of this notice obtain delivery of the oil products they require against receipt but they must refer to the Board of Directors within one month of the date of this notice and effect payment at the standard international rates.

After the expiry of the above period of one month, the sale prices shall be at the standard international rates for quantities which customers of the former AIOC have purchased during the period between January first, 1948, and March twentieth, 1951. For any quantities exceeding these, they shall have priority in purchasing, other terms and conditions being equal.

The Provisional Board of Directors in Charge of Enforcing the Act Concerning the Nationalization of the Oil Industry in Iran.
IRANIAN EMBASSY,
Washington, D. C.

LIKE NEW
6 x 24
WORTHINGTON
HORIZONTAL TRIPLEX PUMP
730 gal. per min. @ 750 lbs. press.,
Wt. 73,500 lbs.
300 H.P. G.E. MOTOR
Type 1-17B w/Starter and Switches
580 R.P.M. Wt. 7800 lbs.
SACRIFICE PRICE!
WRITE—WIRE—PHONE
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DECALS

TRUCK LETTERING AND TRADEMARK decals made for your trucks. Easy to apply, uniform, distinctive, economical for small or large needs. Write for Catalog. Mathews Company, 827 S. Harvey, Oak Park, Ill.

FOR SALE

TITANIUM GEMSTONES

CAN SUPPLY the sensationally beautiful synthetic Titania gemstones, the only thing on earth more brilliant and lively than the diamond; and at a small fraction the cost. Please that little lady with one of these marvelous gems. Ask for folder.

C. C. BOAK, Tonopah, Nevada

5150 acres of fine cotton and maize land for sale, located in Dawson County, Texas, about 12 miles southwest of Lamesa, and all in cultivation. The Sunray recently completed a small well on and near the northeast corner of this land. It is all leased for oil and/or gas to major oil companies or large independent oil companies, except approximately 55 acres, which is unleased. Will sell the land and ¼ royalty; or the land without any mineral interests; or ¼ royalty, either term or perpetual and either participating or non-participating. Correspondence invited, and brokers protected.

W. J. CLAY,
701 W. T. Waggoner Bldg.,
Fort Worth, Texas.

OIL AND GAS

In Western North Dakota and Northwestern South Dakota, I have a well selected spread of oil and gas leases, all of them running for approximately a ten year period. Correspondence invited, and brokers protected.

W. J. CLAY,
701 W. T. Waggoner Bldg.,
Fort Worth, Texas

■ Will act as your buying agent for oil and gas leases and royalties, in the Mid-Continent and Southeastern States fields. C. W. DEMING, Oil Lands Consultant, P. O. Box 1874, Tulsa, Okla., Box 320 Waycross, Ga.

SITUATION WANTED

Drilling contractor operating in West Texas and New Mexico desires to contact small or medium-sized independen oil company who needs an operating manager. Personal interview desired. Twenty years experience in all phases of the oil industry. Address replies to Box 94-W, WORLD OIL, Houston 1, Texas.

■ Petroleum engineer must make change. Has practical experience in production, drilling, and reservoir engineering. Age 33. Box 23-W, c/o WORLD OIL, Houston, Texas.

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

Fraser and Weinreich Are Advanced By Worthington Pump & Machinery

A William Fraser, formerly general European manager, has been appointed Midwest sales manager of Worthington Pump and Machinery Corporation. Fraser will direct the sales of Chicago, St. Paul, Kansas City and St. Louis offices, making his headquarters in Chicago.

William F. Weinreich, formerly assistant superintendent of machine shops at the Buffalo plant, will be in charge of the corporation's newly acquired Oil City, Penn., plant. He will be assistant to vice president Austin C. Ross, who is in administrative charge of the Oil City plant, in addition to being in charge of the Buffalo plant.

A. W. Fraser

W. F. Weinreich

After graduating from Northeastern University with a degree of Bachelor of Mechanical Engineering, Fraser joined Worthington training course in 1929 and became sales engineer in various Worthington offices and plants throughout the country. In 1937 he became Chicago district manager and in 1945 general European manager.

Weinreich graduated from Prof. Egerer's Institute of Technology, Munich, Germany, with the degree of technician in 1922. He came to this country in 1925 and was a tool designer until 1930. He then joined Worthington's Buffalo plant as foreman of the tool room. Four years later he was put in charge of tool design and has been assistant superintendent of machine shops since 1941.

HELP WANTED

Applications now being received from Petroleum, Chemical or Mechanical Engineers with a Ph. D. degree and petroleum reservoir engineering experience for teaching positions on the petroleum engineering staff of a Southwestern institution. Salary based on background. Initiative essential. Interviews during July and September. Appointments effective September 1. Consulting and research encouraged. Send all data including a recent photograph to Box 22-W, WORLD OIL, Houston, Texas.

OIL FIELD SPECIALTY SALESMEN

With own territory to sell a product much needed in production of oil.

DEEP WELLS INC.
P. O. Box 5064
Tulsa, Okla.

New Books, Maps and Movies

North America Geology

Regional geology of the U. S. and adjacent parts of Canada and Mexico is treated in a new 203-page book, "The Tectonics of Middle North America," by Philip B. King, geologist with the U. S. Geological Survey. Description of the area covered, that east of the Cordilleran system, deals with the architecture of the rock formations, how these formations were created, and their modification by subsequent crustal unrest. Theoretical considerations relating to crustal deformation and the formation of mountain ranges, continental shelves, and other features, are also discussed. An extensive bibliography is included with each section, and special geological features in local areas are illustrated by 52 maps and cross-sections.

Princeton University Press, Princeton, N. J. $3.75.

Arc Welding

Fundamentals of arc welding are presented in a new textbook, "New Lessons in Arc Welding." Many types of equipment and welding methods are described.

The Lincoln Electric Company, Cleveland 17, Ohio. $1.

Text on Geology

"Principles of Petroleum Geology," by William L. Russell, associate professor of geology at Texas A. & M. College, is intended primarily as an advanced textbook and for reference use. Rather than detailed descriptions of oil fields and their stratigraphy, principles, methods and techniques are emphasized. Subjects treated include the origin and accumulation of oil, important structures, classification of fields, stratigraphic features such as reefs, geophysics, and various well-logging methods.

McGraw-Hill Book Company, 330 West 42nd Street, New York 18. $7.

The Industry Story

A dramatic presentation for the lay reader, "Oil for the World," by Stewart Schackne and N. D'Arcy Drake, is an effective introduction to the many branches of the oil industry. The generously illustrated 128-page book reviews the significance of petroleum and petroleum products to human welfare and world economy, and gives the essential information about how oil is found, how wells are drilled, how crude is transported and refined, and how products are distributed and marketed.

Harper & Brothers, 49 East 33rd Street, New York 16. $2.50.

Petroleum Technology

Progress made in the scientific and technical aspects of the petroleum industry during 1948 is covered in Volume 10 of the "Annual Reviews of Petroleum Technology." The 350-page book makes reference to more than 2000 articles and patent specifications published during the year. There are 27 articles which discuss advancements in the industry from geological findings to product development.

The Institute of Petroleum, 26 Portland Place, London, W.1. $4.

Leasing Problems

Supplementing and explaining the law and regulations governing mineral leasing on federal lands, "Oil and Gas Leasing on the Public Domain," a new 429-page book, can serve as a reference for the petroleum industry, as well as administrators of public lands. The author, Lewis Edwin Hoffman, is chief of the Branch of Minerals, Division of Adjudication, of the U. S. Bureau of Land Management.

F. H. Gower, First National Bank Building, Denver.

Principles of Viscosity

A scholarly dissertation on "Viscosity and Plasticity," by Dr. E. N. da C. Andrade, Quain Professor of Physics at the University of London, treats of the behavior of materials under varying conditions. The text consists of three lectures arranged by the Oil and Colour Chemists' Association, London.

The Chemical Publishing Company, Inc., 26 Court Street, Brooklyn 2, N. Y. $2.25.

FISHIN'S much FASTER
WITH A
LEBUS
KNUCKLE JOINT
OVERSHOT SYSTEM
The LeBus Knuckle Joint—Overshot System is so efficient that by running the knuckle Joint above the Overshot on every fishing job, you are able to contact the fish quickly and at a minimum of expense. The FO-47 Knuckle Joint will help the Overshot Guide contact the fish quickly on the first run which is insurance against expensive cutting jobs. The cost of cutting a string of stuck pipe is often more expensive than the entire cost of one LeBus FO-47 Knuckle Joint. Have the LeBus Knuckle Joint always available on your derrick floor, and your regular driller becomes an expert fishing tool operator.
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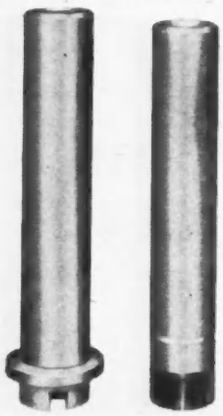
DRILLING EQUIPMENT MFG. CO.
DEMCO
OKLAHOMA CITY, OKLA. U.S.A.

SUPER-FINISH
WASH PIPES



A product of years of experience, engineering know how and skilled workmanship, made from special alloy steel, uniformly heat treated inside and outside to absolute maximum hardness, precision machined under exacting tolerances to specifications. Exclusive finishing process provides a mirror smooth abrasive resistant surface which reduces friction and lengthens life of both the wash pipe itself and the packing.

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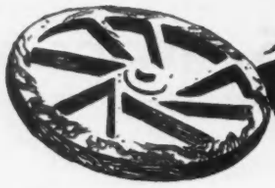


SQUEAKS from the BULLWHEEL

Extenuating Circumstance

A woman called up for jury duty refused because she didn't believe in capital punishment.

Trying to persuade her, the judge explained: "This is merely a case where a wife is suing her husband because she gave a thousand dollars to pay down on a fur coat and he lost the money in a poker game."

"I'll serve," she said. "I could be wrong about capital punishment."

Portrait of a Cad

A joker who haunts Monticello
Is really a terrible fellow.
In the midst of caresses
He fills ladies' dresses
With garter snakes, ice cubes and Jell-O.

Paragon

"Tell me, sir, who was braver than Lancelot, wiser than Socrates, more honest than Lincoln, wittier than Mark Twain, and more handsome than Apollo?"

"My wife's first husband."

The Truth, For Sure

"Say," yelled the farmer, who owned the pond, "don't you see that sign: 'No Fishing Here'?"

"I sure do," said the disgusted angler. "The fellow who printed that sign sure knew what he was talking about."

"Look at them coming in all at once, just when it's my lunch time."

Home Is Where the Warden Is

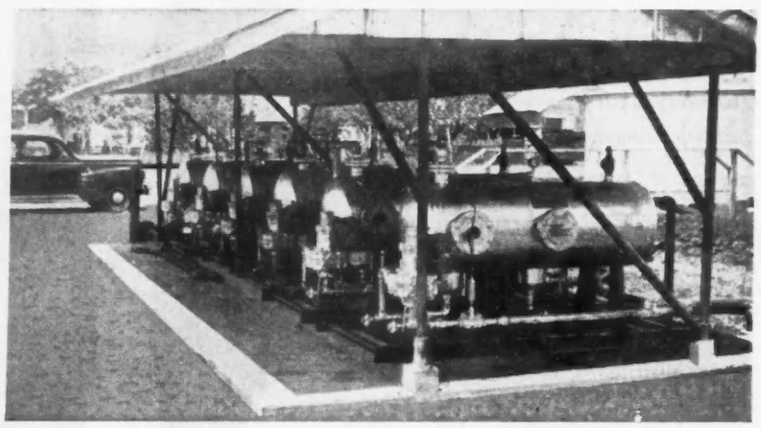
Two days after a big party, two friends met on the street. "Well, old man," said one, "how did you get along after I left you the other night? Did you get home all right?"

"No," was the reply. "A cop saw me and put me in jail for the night."

"You're sure lucky," said the first. "I got home."

ROLO WELLCHECKERS

PERMANENT AND PORTABLE
OIL AND GAS SEPARATORS



This battery of six skid-mounted 4-1H-2406 Rolo Wellcheckers makes it possible to produce six one-well leases into a single tank battery. Installations of this type, of which Rolo Mfg. Co. has made many, are approved by regulatory bodies. Let us work with you on your problem.

Rolo Wellcheckers are made in all sizes to fit any operation. See Composite Catalog or write for illustrated Bulletin.

ROLO

Crude Oil Metering Specialists

MANUFACTURING COMPANY

2510 South Blvd., Houston 6, Texas
BRANCHES: Corpus Christi, Midland, Kilgore, Tulsa, New Orleans, Los Angeles, Casper, Calgary, (Alta.)
EXPORT OFFICE: R. S. Stokvis & Sons, Inc., 17 Battery Place, New York, N. Y.

What's NEW

In Perforating, Testing, and Fishing Tool Services

McCULLOUGH®
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

What You Get With the

McCULLOUGH JET FAMILY

Four Jet Tools That Instantly Cut, Loosen, Fragmentize, and Perforate with Outstanding Results!

YOU GET the advantage of the tremendous POWER of a jet charge, not in only ONE, but in a FAMILY of four jet tools.

You get the speed and accuracy of a tool lowered and positioned electronically on an electric wire line.

You get the controlled, concentrated POWER of a jet charge—harnessed—to accomplish FOUR distinctly DIFFERENT operations in an oil well. Jet power that not only perforates, but CUTS, LOOSENS, and FRAGMENTIZES!

What will the McCULLOUGH JET FAMILY do for you? It will:

1. Slash rig time.
2. Eliminate trouble before complications can set in.
3. Return your well to normal operations with a minimum of delay.
4. Save wells that might otherwise be lost.
5. Simplify fishing.
6. Eliminate guesswork.
7. Save hundreds of feet of valuable drill pipe, casing, and tubing.
8. Permit your well to be completed in less time with less trouble.
9. Give you greater production at less cost.

. . . Adding up to thousands of dollars saved and a better well!

Here are the four members of the McCULLOUGH JET FAMILY and what each one will do for you:

McCULLOUGH JET CASING CUTTER

Slashes Rig Time. This jet tool reduces to a FEW MINUTES, a casing cutting job that would normally take from 10 hours to several days! This is accomplished by eliminating the need of a rotary table and running in and out of the hole with drill pipe or tubing. When fired, the casing is severed in a clean, straight line without damage to an outside string. Accepted as standard practice by major oil companies, it is an ideal companion tool for the McCullough Magna-Tector—used first to locate the stuck point.

McCULLOUGH JET BACK-OFF TOOL

Permits Recovery of Stuck Pipe Without Cutting. Instead of cutting, the jet charge in this tool is so controlled that it LOOSENS the box of a tool joint or coupling, without damage in most cases, permitting it to be freely unscrewed. Only the exact joint to be unscrewed is effected. This tool is also an ideal companion tool for the McCullough Magna-Tector.

McCULLOUGH BOTTOM HOLE JET CUTTER

Fragmentizes Obstructions to Progress. Large pieces of junk in the bottom of the well that are too large to be recovered or too difficult to be recovered are instantly broken up into small pieces with this jet tool. Articles such as: rock bits, slips, reamer bodies; etc., are fragmentized so that they can be recovered by usual methods.

McCULLOUGH GLASS JET PERFORATORS

More Oil Through Cleaner Deeper Holes. Available in a Flexible Steel Strip Carrier and in a Solid Steel Gun Body. Both Casing and Super Formation Type Guns. Improvements in design have resulted in 75.9% GREATER PENETRATION! through solid steel plate with 37.5% LESS EXPLOSIVES! 50% stronger Steel Strip Carrier eliminates possibility of debris and permits MAXIMUM charge of jet explosives in SMALL PIPE, where MORE POWER is needed. Flexibility of Steel Strip permits passage through bad pipe, kinks, etc. Consistently increases production in tough wells, even after all other methods have failed!

PROGRESS AND PRODUCTION

For Trouble-Free Progress and Greater Production—You NEED the McCULLOUGH JET FAMILY! And there is only ONE WAY to find out how much you can save by using these tools. That way is to call your nearest McCullough Service Engineer. He is available in your area for free consultation. The proof is in your well.

WRITE FOR THIS CATALOG

Write for your copy of the new McCullough section of the Composite Catalog. Detailed information, illustrations, and specifications on the McCULLOUGH JET FAMILY are included in this catalog. Write for your free copy today.

PERFORATING, TESTING AND FISHING SERVICE ANYWHERE — ANYTIME!

McCULLOUGH TOOL COMPANY
5820 South Alameda Street, Los Angeles 58, California
405 McCarty Street (P. O. Box 2575) • Houston, Texas

CANADA: Edmonton, Alberta • **EXPORT OFFICE:** Los Angeles, California
VENEZUELA: United Oilwell Service Co., S.A.; Caracas, Anaco, Maracaibo

SERVICE LOCATIONS: TEXAS: Houston, Snyder, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, San Angelo, Victoria, Wichita Falls. **OKLAHOMA:** Oklahoma City, Guyman, Healdton. **MISSISSIPPI:** Laurel. **NEW MEXICO:** Hobbs. **KANSAS:** Great Bend. **WYOMING:** Casper. **CALIFORNIA:** Los Angeles, Avenal, Bakersfield, Ventura. **LOUISIANA:** Houma, Lake Charles, New Iberia, Shreveport. **COLORADO:** Sterling.

Mid-Continent NEWS and HUMOR?

OKLAHOMA CITY
Remodeled & Restocked

It's the same address—903 SE 29th Street—but it's had a face liftin'! Yep, our Oklahoma City store hasn't moved an inch, but you would hardly know the place.

Outside it has a brand new front with a gleaming Mid-Continent Supply Co. sign stretched across the front tying in with that famous neon oil-spouting derrick on top the building . . . inside it's been enlarged, remodeled and restocked with finest products in the oil field supply business . . . and, there's some new, experienced personnel on hand, as well as the old crew, to assure you of the finest service available.

Mid-Continent NEWS Original Cartoon

MID-CONTINENT Supply Company

General Offices Mid-Continent Bldg. FORT WORTH, TEXAS

SQUEAKS FROM THE BULLWHEEL

Carry-Through

An elderly gentleman, cursed from birth with a face even his mother found unpleasant, was shambling aimlessly down a side street when a lovely young lady beckoned to him from a second-story window.

He could scarcely believe it was he she was signalling, but a look around disclosed that there was not another soul in the street. Her smile grew more inviting and her invitation more urgent when he seemed to hesitate.

Unused to such adventure, the man blushed violently, and then, with a sudden resolve, rushed into the house and labored up the stairs. She was waiting for him at the landing, dressed in a shimmering silken negligee. She linked her arm in his, and led him straight through the parlor to a bedroom in the back—and a golden-haired little girl of two who was throwing a tantrum in her crib. "You see," said the siren triumphantly. "I told you the bogeyman would come if you didn't stop crying!"

Good Citizen

A speaker was lecturing on forest conservation.

"I don't suppose," he said, "that there is one person in the audience who has done a single thing to conserve our timber resources."

Silence ruled for seconds, then a meek voice asserted: "I once shot a woodpecker."

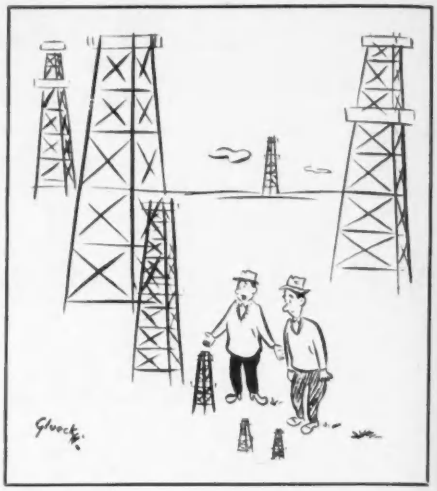
A Good Girl Gone Wrong

Here lies the body
Of Miss Bertha Bright.
She signaled for left
And then turned right.

Time Work

Patient: "Five dollars is an awful lot of money for pulling a tooth—two seconds' work."

Dentist: "Well, if you wish, I can pull it very slowly."



". . . Petered out along about here."

Qualification

A man who was answering an ad for a chauffeur's job was being examined by the car owner. He was asked if he had traveled much in other states. "Yes sir," replied the prospective chauffeur.

"All right," said the car owner, handing him a road map, "Let's see you fold it."

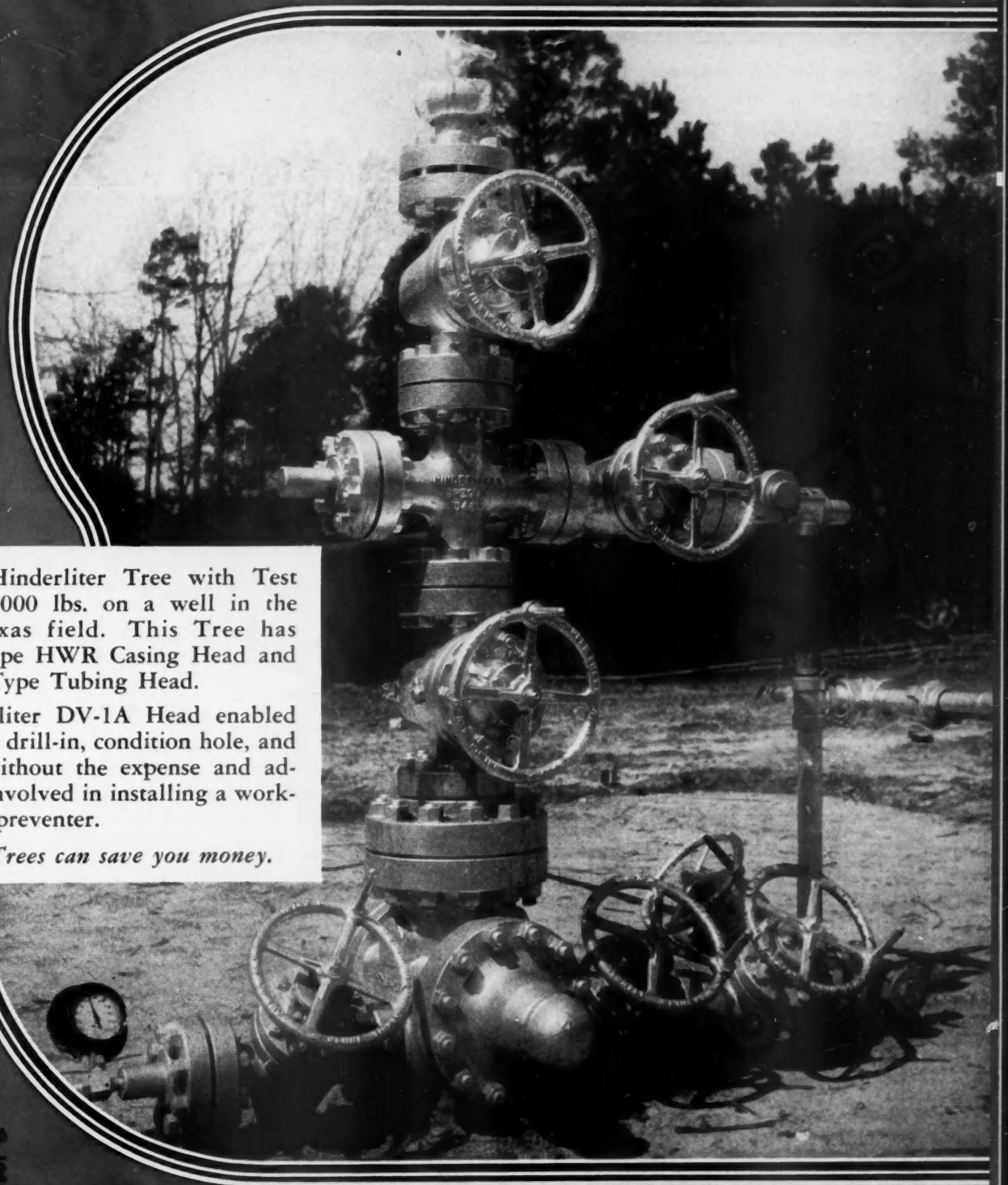
Past Performance Tells

All day the weary elevator operator had been patiently answering questions the department store shoppers had thrust upon him. Just before closing time, a voice asked from the rear of the crowded car, "Suppose the elevator cables broke, would we go up or down?"

Unable to compose himself any longer, the operator snapped, "That, my dear lady, depends entirely upon the kind of life you've been leading."

HINDERLITER

"Better Built" TREES



A typical Hinderliter Tree with Test Pressure of 6,000 lbs. on a well in the Carthage, Texas field. This Tree has Hinderliter Type HWR Casing Head and DV-1A Ram Type Tubing Head.

The Hinderliter DV-1A Head enabled the operator to drill-in, condition hole, and land tubing without the expense and additional time involved in installing a work-over blowout preventer.

Hinderliter Trees can save you money.

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SQUEAKS FROM THE BULLWHEEL

Defeat Before the Battle

The two old bachelors got off on the subject of cooking and one of them commented:

"I got one of them thar cookery books once, but I never used it. Too much fancy work in it."

"How come?" asked the other.

"Why, every one of those recipes began: 'Take a clean dish.' and that stopped me."

How to Stock a Zoo

The new method of catching elephants requires a piece of paper, a milk bottle, a pair of tweezers and binoculars. Go to the elephant country, find a pool of water and write on the paper: "For Elafants." When the elephants come up to drink, they will see that their name is spelled wrong and start laughing. When the other elephants hear them laughing, they will come up to see what they are laughing about. At that point you look at the elephants through the wrong end of the binoculars. The elephants look so small that you pick them up with the tweezers and put them in the milk bottle!

Capital Service

In Washington, where people have been sharing taxis for years, a young matron, obviously soon to become a mother, hesitated before entering a crowded cab at Union Station.

"Get right in, lady," urged the driver. "We have everything in here but the hot water." She got in, somewhat puzzled, and blushed when she saw that her companions were an army doctor, a navy nurse, and a priest.

His Turn

There's many a driver who will understand the motivation of the fellow who drew up his chair beside his wife's sewing machine and started to chatter: "Don't you think you're running too fast? Look out! You'll sew the wrong seam. Mind that corner now! Slow down, watch your finger. Steady!"

Bad Form

The American was visiting in England and having a glorious time. His hosts decided to take him on a fox hunt. He was overjoyed and they left shortly afterwards in chase of the fox.

That evening, as they came back, the guest was alone. He was shunned by everyone. No one said a word to him. Soon, he could stand it no longer and asked his host if he knew why this sudden change in behavior.

The host said to him distastefully, "In this part of Sussex, my good man, when we go hunting and corner the fox, the expression is 'Tally-Ho' and not 'There goes the little --- -- - -----!' "

Nature Study

"Dad, do they raise political plums from seed?"

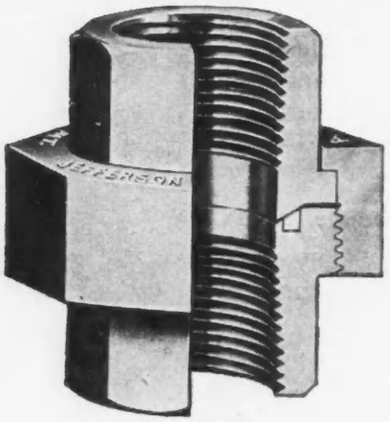
"No, my boy, political plums are more often the result of a bit of clever grafting."

Personnel Relations

"How long was your last cook with you?"

"She never was with us. She was against us from the start."

Jefferson Malleable Unions



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JEFFERSON Style "A" Unions and Style "A" Union Fittings can be furnished with Brass-to-Iron, and Iron-to-Iron Seats.

HYDRAULIC PRESSURE RATING

Sizes	Test Pres.	OWG	SWP
⅛" thru 2"	4000#	1500#	500#
2½"	3000#	1200#	300#
3" and 4"	2000#	800#	300#

Our "Iron-to-Iron seat" unions are highly recommended and especially desirable where sulphur content of oil is high; also for chemical services where acid-bearing liquids or gases require the use of iron fittings. AIR FURNACE IRON, having a much denser and finer grain structure, gives a dependable and positive seating surface—ASTM-4733-Grade 35018-53000-lb. M.T.

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HEAVING SHALE

Heaving shale is a barrier that has scared many an operator away from areas which otherwise were considered attractive prospects for exploratory drilling. Fortunately, improvements in equipment, drilling techniques, and drilling mud have reduced the hazard of drilling in these areas to a minimum. It now appears that hole trouble described as "heaving shale" is a condition of the hole rather than a particular formation. Heaving shale is still a chronic drilling problem, but the industry has know-how and specialized mud material to control it. Magcobar is glad to have played an important part in helping the industry eliminate heaving shale from the category of an "impenetrable formation." Magcobar serves the industry with the specialized mud materials for handling this problem, and their experienced field engineers will assist you in their use. When heaving shale is a probable barrier to reaching your drilling objective—call your Magcobar engineer.

NOHEEV — A special silicate of soda for preparing silicate-brine muds that prevent hydrous disintegration of bentonitic shale. Available as dry powder or concentrated liquid.

MAGCOBAR HEAVY MUD WEIGHT — A barium sulfate with a high specific gravity especially prepared for building high weight muds needed to control the high pressure gas and salt water often associated with heaving shale.

MY-LO-JEL — A special pre-gelantinized drilling mud starch for lowering the water loss of mud which reduces the wetting of water reactive heaving shales.

QUEBRACHO — A powerful dispersing agent for thinning mud and improving the wall building properties of the mud.

TANNATHIN — A protective colloid which stabilizes mud and improves wall building qualities.

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